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*By WILLIAM BABINGTON, M. D.*  
ASSISTANT PHYSICIAN, AND LECTURER IN CHEMISTRY, AT GUY'S HOSPITAL.

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ᶜ L O N D O N :

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1799.

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~~Good 9257,99~~

1860 Oct 9  
The Life of  
Shaver William Folsom  
of Beria  
H B 1845-



4325  
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TO

SIR JOHN ST. AUBYN, BART.

SIR,

ALTHOUGH I am far from considering the following performance as worthy of a formal Dedication, I cannot help availing myself of the opportunity which it offers (the only public one I may ever have) of acknowledging the many civilities which you have condescended to show me. Permit me, at the same time, to assure you, that, however imperfect the Work may be, my solicitude in executing it has not been the less, that the Collection to which it refers has passed into your possession: that Collection it may tend to render more valuable, and thereby entitle me in some degree to a continuance of the confidential freedom with which you have hitherto allowed me to consult it.

I am, SIR,

with most sincere respect,

your obliged and grateful servant,

*Basinghall-street,  
Oct. 1, 1799.*

W. BABINGTON.

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## ADVERTISEMENT.

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IN committing the following Work to the press, the Author has been influenced by the same motives that induced him to publish his *SYSTEMATIC ARRANGEMENT OF MINERALS* in 1795; of which this may be considered a continuation, necessary to complete the design with which that arrangement was undertaken. He had been employed, as then mentioned, in forming from the extensive and valuable collection of the late *Earl of Bute* a more compendious and select cabinet, now in the possession of *Sir John St. Aubyn, Bart.* and as this required not only a considerable length of time, but also a degree of attention much beyond what was at first conceived necessary for such an undertaking, the author thought, that in making public the system which he had adopted, he might considerably abridge the labour of those who should hereafter engage in a similar task, and likewise render an acceptable service to such as wished to acquire a comprehensive knowledge of mineralogy, but who had neither leisure nor inclination, even if they had an opportunity, to consult the numerous works through which the necessary information lay scattered. Besides, as no endeavours had been spared to render the collection from which that synopsis was drawn up, one of the most perfect in a scientific point of view, it was hoped that the annexed catalogue would afford to such as had advanced a considerable way in the business of collecting, an opportunity of determining the comparative value of what they already possessed, as well as what articles might yet be wanting to render their cabinets more complete.

The Work itself will shew of what assistance the author has principally availed himself; that in the distribution of his system into *CLASSES, ORDERS, GENERA, and SPECIES*, as founded on *chemical*, and the varieties on *external* characters, he has nearly adopted the arrangement of *Baron Born*, in his catalogue of the collection of *Mademoiselle Eléonore de Raab*; that *R. de Lisle* has been his guide on the subject of crystallisation; that  
most



most of the generic descriptions correspond with those of *Widenmann* and *Emmerling*, disciples of the celebrated *Werner*; and that he is chiefly indebted to *Mr. Kirwan* for what respects the chemical properties and analyses of the different species.

The conclusion of the advertisement prefixed to the Author's former work may, he thinks, with still greater propriety, be applied to this, namely, that however simple the performance may appear to some, yet such as are better acquainted with the nature of the subject must know, that to execute it, even with tolerable correctness, requires much labour in collecting, and some judgment in arranging, the materials. He had then occasion to acknowledge his obligations to his friend *Dr. Mitchell*, and now he feels it equally incumbent on him to return his grateful thanks for the assistance which he has since received from his friends *Mr. Richard Stocker*, of *Guy's Hospital*, and *Mr. Arthur Aikin*, of *Broad-street*.

CLASS

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## CLASS I. *SALTS.*

**T**HE bodies comprehended under this class are distinguished by being sapid to the taste, readily soluble in water, incombustible, and incapable of being metallized. They possess a strong disposition to unite with other bodies, therefore seldom found uncombined. When in a concrete form, they are differently affected by exposure to air, some becoming deliquescent, others efflorescent, whilst some remain unaltered. By solution in water they produce a change of temperature. Most of them are capable of being more or less perfectly crystallized, in which state, if exposed to heat, they undergo true or watery fusion, decrepitation or decomposition, according to the degree and mode in which it is applied.

They may be divided into simple and compound.

### ORDER I. *SIMPLE.*

#### GENUS I. *ACID.*

The acids are usually distinguished by their being of a sour taste and changing vegetable blues to red. They all unite readily with water. In combination with alkalis they form, for the most part, what are called neutral salts; with earths and metallic oxyds, earthy and metallic salts. Most of the acids are antiseptic; some powerfully corrosive. From modern experiments, they appear to consist of different inflammable substances united to the basis of oxygen.

The mineral acids hitherto found in an uncombined state are,

#### SPECIES I. *CARBONIC ACID.*

*Aërial Acid. Fixed Air. Acide Carbonique, Fr. Luftsäure, Germ.*

Found either in a gaseous state in caverns and other subterranean situations, or impregnating the water of certain springs.

Analysis.—Carbon 17, Oxygen 83. *Chaptal.*

#### SPECIES II. *BORACIC ACID.*

*Sedative Salt. Acide Boracique, Fr. Seditivsalz, Germ.*

B

VARIETY

VARIETY I. IN SOLUTION.

SPECIES II. MURIATE OF POTASH.

*Digestive Salt of Sylvius. Muriate de Potasse, Fr.*

Analysis.—Acid 31, Alkali 61, Water 8. *Berg.*

VARIETY I. IN SOLUTION.

SPECIES III. NITRATE OF POTASH.

*Nitre. Salt Petre. Nitrate de Potasse, Fr.*

Analysis.—Acid 33, Alkali 49, Water 18. *Berg.*

VARIETY I. IN SOLUTION.

SPECIES IV. SULPHATE OF POTASH.

*Vitriolated Tartar. Sulfate de Potasse, Fr.*

Analysis.—Acid 40, Alkali 52, Water 8. *Berg.*

VARIETY I. IN SOLUTION.

GENUS II. BASE, SODA.

SPECIES I. CARBONATE OF SODA.

*Natron. Carbonate de Soude, Fr. Mineralisches Laugensalz, Germ.*

Analysis.—Acid 16, Alkali 20, Water 64. *Berg.*

VARIETY I. EFFLORESCENT.

I. a 1. Native mineral alkali, concrete, of a dull white colour. *Teneriffe.*

Of this very large quantities have been imported into this country in the course of the last few years.

VARIETY II. IN SOLUTION.

SPECIES II. BORATE OF SODA.

*Borax. Borate de Soude, Fr. Tinkal, Germ.*

B 2

VARIETY

## VARIETY I. IN SOLUTION.

Discovered free from combination with alkali, by *Mr. Haëffer*, in the waters of certain lakes in Tuscany.

## SPECIES III. SUPHURIC ACID.

*Acid of Vitriol.*    *Acide Sulphurique*, Fr.    *Vitriolsäure*, Germ.

## VARIETY I. CONCRETE.

*Glacial Vitriolic Acid.*

Found concrete and even crystallised in certain volcanic grottos of Tuscany and Ætna.

Analysis.—Sulphur 72, Oxygen 28. *Berthollet*.

## VARIETY II. LIQUID.

## VARIETY III. GASEOUS.

*Volatile Vitriolic Acid.*

## GENUS II. ALKALI.

The alkalis are distinguished by being of a pungent, lixivial, or urinous taste, and changing most vegetable blue colours to green, and many of the yellows to brown. They have, like most of the acids, a strong attraction for moisture, and when applied to the living body are very powerfully caustic. In consequence of their great tendency to union with other bodies, they have not, as yet, been found uncombined.

## ORDER II. COMPOUND.

## GENUS I. BASE, POTASH.

In this and the two following genera the alkalis and acids, of which they are composed, are united in such proportions as that, except in the case of carbonates, neither are found to predominate.

## SPECIES I. CARBONATE OF POTASH.

*Aërated Vegetable Alkali.*    *Carbonate de Potasse*, Fr.    *Gewächs Laugenfalz*, Germ.

Analysis.—Acid 23, Alkali 70, Water 5. *Bergman*.

VARIETY

VARIETY I. IN SOLUTION.

SPECIES II. MURIATE OF POTASH.

*Digestive Salt of Sylvius. Muriate de Potasse, Fr.*

Analysis.—Acid 31, Alkali 61, Water 8. *Berg.*

VARIETY I. IN SOLUTION.

SPECIES III. NITRATE OF POTASH.

*Nitre. Salt Petre. Nitrate de Potasse, Fr.*

Analysis.—Acid 33, Alkali 49, Water 18. *Berg.*

VARIETY I. IN SOLUTION.

SPECIES IV. SULPHATE OF POTASH.

*Vitriolated Tartar. Sulfate de Potasse, Fr.*

Analysis.—Acid 40, Alkali 52, Water 8. *Berg.*

VARIETY I. IN SOLUTION.

GENUS II. BASE, SODA.

SPECIES I. CARBONATE OF SODA.

*Natron. Carbonate de Soude, Fr. Mineralisches Laugensalz, Germ.*

Analysis.—Acid 16, Alkali 20, Water 64. *Berg.*

VARIETY I. EFFLORESCENT.

I. a 1. Native mineral alkali, concrete, of a dull white colour. *Teneriffe.*

Of this very large quantities have been imported into this country in the course of the last few years.

VARIETY II. IN SOLUTION.

SPECIES II. BORATE OF SODA.

*Borax. Borate de Soude, Fr. Tinkal, Germ.*

B 2

VARIETY

## VARIETY I. CRISTALLISED.

Analys. — Acid 34, Alkali 17, Water 47. *Delametherie.*

II. *a* 1. In truncated hexhedral prisms of a brownish colour. *Thibet.*

The refinement of rough borax, of which this is a variety is now successfully carried on by several artists in this country, and probably depends in a great measure upon crystallization on the large scale. The quantity annually imported from the East Indies amounts to several tons. It loses in refinement from  $\frac{1}{4}$  to  $\frac{1}{2}$  per cent.

## VARIETY II. IN SOLUTION.

## SPECIES III. MURIATE OF SODA.

*Common Salt. Sea Salt. Muriate de Soude, Fr.*

## VARIETY I. CRISTALLISED.

Analys. — Acid 52, Alkali 42, Water 6. *Berg.*

III. *a* 1. In colourless cubes aggregated on crystallised gypsum. *Tyrol.*

IV. *a* 2. In transparent cubes and rectangular parallelepeids of a smaller size and irregularly aggregated. *Salzboung.*

V. *a* 3. In large transparent cubic crystals with opaque muriate of soda imbedded in indurated clay. *Tyrol.*

VI. *a* 4. Fragment of a large rectangular transparent crystal. *Salzboung.*

## VARIETY II. AMORPHOUS.

VII. *a* 1. In an irregular mass composed of parallel fibres, of a yellowish white colour with blue veins. *Same Place.*

VIII. *a* 2. In detached pieces transparent and of a fibrous texture. *Wirtemberg.*

IX. *b* 1. In an amorphous mass of a flesh red colour and granular texture. *Salzboung.*

X. *b* 2. The same of a whitish red colour, in some parts fibrous. *Same place.*

XI. *b*

XI. *b* 3. The same of a still paler colour.

*Same place.*

XII. *b* 4. Of a milk white colour, irregularly tuberculated on the surface of impure muriate of soda.

*Upper Austria.*

XIII. *b* 5. In an irregular mass of a pale flesh red colour and granular texture.

*Northwich, Cheshire.*

The produce of the mines from which this specimen is taken is greater than that of any other we are acquainted with, exceeding even the celebrated mines of Wilizka. Vide *Watson's Chemical Essays*, Vol. II.

SPECIES IV. *SULPHATE OF SODA.*

*Glauber's Salt. Salphate de Soude, Fr.*

Analysis.—Acid 27, Alkali 15, Water 58. *Berg.*

VARIETY I. *IN SOLUTION.*

GENUS III. *BASE AMMONIAC.*

SPECIES I. *CARBONATE OF AMMONIAC.*

*Aerated Volatile Alkali. Carbonate Ammoniacal, Fr.*

Analysis.—Acid 45, Alkali 43, Water 12. *Berg.*

VARIETY I. *IN SOLUTION.*

SPECIES II. *MURIATE OF AMMONIAC.*

*Crude Sal Ammoniac. Muriate d'Ammoniaque, Fr. Salmiac, Germ.*

VARIETY I. *CONCRETE.*

Analysis.—Acid 52; Alkali 40, Water 8. *Delameth.*

I. *a* 1. Native Sal Ammoniac in detached pieces.

*Vesuvius.*

SPECIES III. *NITRATE OF AMMONIAC.*

*Nitrate d'Ammoniaque, Fr.*

Analysis.—Acid 46, Alkali 40, Water 14. *Delameth.*

VARIETY

VARIETY I. *Mixed with NITRATE OF POTASH.*

SPECIES IV. *SULPHATE OF AMMONIAC.*

*Sulfate Ammoniacal, Fr.*

VARIETY I. *CONCRETE.*

Analysis.—Acid 42, Alkali 40, Water 18. *Dalameib.*

## CLASS II. *EARTHS.*

THESE are distinguished by their brittleness, fixity, sparing solubility in water, insipidity, want of odour, incapacity of communicating a tinge to glass or of being metallised, and their specific gravity not exceeding that of water more than in the proportion of 5 to 1. Some of the earths however possess these characters more perfectly than others, and hence the distinction into saline and insipid. They are all naturally of a white colour; they are all also soluble in one or other of the acids, from their solutions in which they cannot be precipitated by prussiate of potash or of lime, as is the case with all metals, platina excepted.

The pure earths at present known are lime, strontian, baryt, magnesia, alumine, silica, adamantine earth, jargon earth, of which the six first are the most common.

### ORDER I. *HOMOGENEOUS.*

#### GENUS I. *LIME.*

The state to which the properties of this earth more particularly refer, is that in which it is obtained from carbonate of lime for various purposes, by the continued application of a strong heat. Its form is either concrete or powdery; colour, white; taste, hot, pungent, caustic; specific gravity 2.3. It is soluble in about 700 times its weight of water at a common temperature, and in this form, like the alkalis, changes vegetable blue colours to green. On exposure to air, if in the concrete state, it loses gradually its attraction of cohesion, and in process of time recovers its original hardness,



ness, by the absorption of carbonic acid gas from the atmosphere. On being suddenly moistened, it falls more immediately into powder, becomes luminous in the dark, and, by the sudden evolution of its caloric, produces a remarkable increase of temperature. Though by itself infusible, it promotes very powerfully the fusion of all the other earthy bodies, and is therefore successfully employed as a flux on several very important occasions. It melts with borax and microcosmic salt without effervescence. It melts also with oxyd of lead. With the sulphuric and carbonic acids, it forms compounds of little solubility in water, unless these acids be in excess; but with the nitric and muriatic, salts which are strongly deliquescent. Though supposed in many instances to be of animal origin, yet in others it would seem impossible that it should be derived from this source, as in the case of primitive marble and lime-stone, and more especially granite.

### SPECIES I. PURE LIME.

#### VARIETY I. AMORPHOUS.

I. *a* 1. Pure lime of a dull yellowish white colour and earthy texture. *Bath.*

\* *b*. Loose.

The uncombined calcareous earth contained in this stone was discovered by Dr. Falconer. We learn also from M. Monet that pure lime, of a yellowish colour, is found in great abundance in the mountains of Upper Auvergne.

### SPECIES II. CARBONATE OF LIME.

*Aërated or mild Lime. Carbonate calcaire, Chaux Aërée, Fr.*

All the varieties of this species effervesce with the stronger acids, and burn into quick lime.

#### VARIETY I. CRISTALLISED.

*Calcareous Spar. Spath calcaire, Fr. Kalkspath, Germ.*

Analysis.—Acid 34, Lime 55, Water 11. *Berg.*

Besides the great diversity observable in the colour, transparency, and configuration of the individuals of this variety, they are also remarkable for being of a laminated texture and separating into rhomboidal fragments, which, when transparent, have the property of giving a double refraction. When exposed to heat, they become opaque and decrepitate, if it be suddenly applied; but are infusible without addition even in the focus of a burning glass. They are found principally in mountains composed of horizontal strata, and have been considered as posterior in their formation to primitive marble and lime-stone.

II. *a 1.* In small compressed rhomboidal parallelepipeds colourless and transparent, grouped on the surface of white crystallised quartz, with orange coloured pearl spar.

*Romé de Lisle, Plate 4. Figure 1.*

*Schemnitz, Hungary.*

III. *a 2.* In larger transparent crystals of the same figure, with dodecahedral crystals of white transparent staurolite, on laminated calcareous spar.

*Strontian, Argyleshire.*

IV. *a 3.* In very compressed rhomboidal parallelepipeds, semitransparent and of a whitish colour, set edgewise on laminated baroselenite.

*Andreasberg, Hartz.*

*R. de L. Pl. 4. Fig. 5.*

V. *a 4.* The same, of a smoke grey colour, aggregated and without matrix.

*Brittany.*

VI. *a 5.* The same, in more compressed crystals, aggregated so as to produce the semblance of cocks' combs.

*Freyberg, Saxony.*

VII. *a 6.* The same, in small crystals, white, semi-transparent, implanted one on the other, so as to form numerous columns on quartz intermixed with pyrites.

*Schemnitz.*

VIII. *a 7.* The same, in very thin lenticular crystals, semitransparent, and forming a groupe in which the crystals are set edgewise.

*Joachimsthal, Bohemia.*

IX. *a 8.* In transparent compressed rhomboidal parallelepipeds, having the solid angles, at the junction of their trihedral pyramids, truncated; with black blende and cubic fluor.

*Durham.*

*R. de L. Pl. 4. Fig. 6.*

X. *a 9.* The same, in aggregated crystals, translucid and of a whey colour, the solid angles more deeply truncated.

*Cumberland.*

*R. de L. Pl. 4. Fig. 6.*

XI. *a 10.* The same, also translucid and of a whey colour, still more deeply truncated, on pyramidal quartz.

*Same place.*

*R. de L. Pl. 4. Fig. 7.*

XII. *a 11.* The same, forming numerous small columns, which support a large crystal of the same configuration (shewing the transition into the hexhedral prism) terminated by trihedral pyramids with pentagonal faces.

*Andreasberg, Hartz.*

*R. de L. Pl. 4. Fig. 7.*

XIII. *a*

**XIII. b 1.** In lengthened rhomboidal parallelepipeds, of a yellow colour, lining the internal surface of an hollow piece of petrified wood. *Norway.*

*R. de L. Pl. 4. Fig. 45.*

**XIV. b 2.** The same, lining the cavity of a fossil bivalve. *Same place.*

**XV. b 3.** In aggregated crystals of the same figure, of a reddish white colour and transparent. *France.*

**XVI. b 4.** In crystals of a grey colour and of the same figure, but of different sizes, with a partial sparry coating; on white calcareous spar intermixed with baroselenite.

*Derbyshire.*

**XVII. b 5.** In small aggregated rhomboidal crystals, of a smoke grey colour, forming a tuberculated incrustation on laminated white calcareous spar. *Cumberland.*

**XVIII. b 6.** In large aggregated crystals of a pale yellow colour, lengthened into acute trihedral pyramids, with numerous smaller ones projecting from their sides.

*Andreasberg, Hartz.*

**XIX. b 7.** The same, in similar smaller crystals, covering the surface of coarse grained carbonate of lime. *Bath.*

**XX. b 8.** In very acute aggregated trihedral pyramids, having each face bevelled at its extremity.

*Andreasberg, Hartz.*

*R. de L. Pl. 4. Fig. 50.*

**XXI. b 9.** The same, in smaller and more obtuse pyramids, with concave faces, forming a crystallised coating taken from the surface of blue clay. *Same place.*

**XXII. b 10.** The same, in small white transparent crystals arranged in rows, in a cavity in white porous lime-stone. *Norway.*

**XXIII. c 1.** In short hexhedral prisms, with trihedral pyramids, having rhombic faces, irregularly implanted on brown blende, partially incrustated by minute crystals of quartz. *Cumberland.*

**XXIV. d 1.** In hexhedral prisms of a water colour, terminated by trihedral pyramids with convex pentagonal faces, on blende and carbonate of lime. *Freyberg, Saxony.*

*R. de L. Pl. 4. Fig. 9.*

XXV. *d* 2. The same, in smother and more transparent crystals on crystallised quartz. *Cumberland.*

XXVI. *d* 3. The same, in larger crystals. *Same place.*  
*R. de L. Pl. 4. Fig. 9.*

XXVII. *d* 4. The same, rather less transparent on quartz with yellow pyrites. *Andreasberg, Hartz.*

XXVIII. *d* 5. In smaller crystals of the same figure somewhat decomposed, and having a brush-like appearance at their extremities on semitransparent pyramidal quartz. *Same place.*

XXIX. *d* 6. In hexhedral prisms with a smoky grey tinge on the surface, having the faces of the pyramids perfectly flat, on calcareous spar intermixed with native bismuth and yellow sulphate of barye. *Freyberg, Saxony.*

XXX. *d* 7. In short hexhedral crystals of a milky colour, aggregated into irregular columns, on white quartz intermixed with mispickel. *Andreasberg, Hartz.*

XXXI. *d* 8. The same, in which the crystals have formed on hexhedral pyramidal crystals of calcareous spar; the apices of which protrude through the pyramids of the secondary crystals. *Freyberg, Saxony.*

XXXII. *d* 9. In transparent water coloured hexhedral prisms, with unequal sides, and terminated by trihedral summits, on white quartz. *Cumberland.*  
*R. de L. Pl. 4. Fig. 10.*

XXXIII. *d* 10. In transparent prismatic crystals of the same figure, some extremely delicate, and needle-like, decussating each other in various directions, on grey calcareous spar intermixed with white quartz. *Andreasberg, Hartz.*

XXXIV. *d* 11. In transparent hexhedral crystals somewhat opaque at their extremities, irregularly aggregated on calcareous spar and galena. *Same place.*

XXXV. *e* 1. In hexhedral prisms, with trihedral pyramids, having the solid angle of the pyramid more or less deeply truncated. *R. de L. Pl. 4. Fig. 15, 16, 17.*

XXXVI. *f* 1. In hexhedral prisms, truncated at both extremities and of a reddish brown colour, with red ferruginous calcareous earth, in white striated gypsum. *Between Arragon and Valencia, Spain.*  
*R. de L. Pl. 4. Fig. 18.*

XXXVII.

XXXVII. *f* 2. In hexhedral truncated prisms, perfectly transparent, but of a pearl colour at the summits, with larger rhomboidal crystals, implanted on the surface of an irregular crystallisation of transparent calcareous spar. . *Andreasberg, Hartz.*

XXXVIII. *f* 3. The same, in hexhedral columns, composed of subordinate crystals, the columns variously inclined. *Same place.*

XXXIX. *f* 4. The same, in long transparent hexhedral prisms, on the truncated extremities of which lie thin hexhedral plates. *Same place.*

XL. *f* 5. In short hexhedral transparent prisms, the sides alternately broad and narrow, of a milk white colour at their extremities, irregularly aggregated into a group. *R. de L. Pl. 4. Fig. 19. Same place.*

XLI. *f* 6. The same, also in short transparent prisms, and of an opaque pearl colour at both extremities, lying on grey calcareous spar. *Same place. R. de L. Pl. 4. Fig. 21.*

XLII. *f* 7. In larger crystals nearly of the same figure, but the 'pearly opacity of both extremities extending almost to the centre. *Same place. R. de L. Pl. 4. Fig. 21.*

XLIII. *f* 8. The same, in small grey crystals, aggregated into irregular columns. *Same place.*

XLIV. *f* 9. In numerous short hexhedral truncated prisms, on grey lime-stone. *Same place.*

XLV. *f* 10. The same, lying edgeways, on a calcareous incrustation. *Cumberland.*

XLVI. *f* 11. In white semitransparent hexhedral prisms, truncated at their summits; some with six sides, alternately broad and narrow; some with five, unequal; some with four, the opposite sides equal; on calcareous spar intermixed with blende. *Hartz.*

XLVII. *f* 12. In thin truncated hexhedral prisms, of a mother of pearl lustre, piled irregularly on one another, on greyish calcareous spar. *Same place. R. de L. Pl. 4. Fig. 23.*

XLVIII. *f* 13. In large flat triangular plates, semitransparent, and of a white colour, formed by the enlargement of three alternate sides of the hexhedral prism at the expence of the intermediate ones, attached to each irregularly. *Same place.*

XLIX. *f* 14. In rhomboidal crystals seemingly compounded of laminæ similar to the last, applied to each other base to base and irregularly decreasing, with numerous minute crystals of white zeolite, on greyish calcareous spar. *Same place.*

L. *g* 1. In acute hexhedral pyramids, joined alternately base to base, of a brown colour, forming a cluster on an incrustation of quartz. *Ashbover, Derbyshire.*  
*R. de L. Pl. 4. Fig. 28.*

LI. *g* 2. The same, in larger transparent crystals, of a yellow colour, with brown blende. *Derbyshire.*

LII. *g* 3. The same, in large yellowish opaque crystals internally corroded. *Same place.*

LIII. *g* 4. The same, in small transparent crystals aggregated into a group, and intermixed with arboresecent galena. *Leicestershire.*

LIV. *g* 5. The same, in larger compounded crystals, inclosing numerous specks of yellow pyrites on a greyish lime-stone. *Derbyshire.*

LV. *g* 6. The same, in crystals more acuminate and without pyrites, aggregated laterally into an irregular group. *Hartz.*

LVI. *g* 7. The same, in small transparent crystals of a topaz colour, covering the surface of white calcareous spar. *Derbyshire.*

LVII. *g* 8. In semitransparent double pyramidal crystals of a white colour, on a whitish granular lime-stone. *Hartz.*

LVIII. *g* 9. The same, in larger crystals of a water colour, scabrous on the surface. *Same place.*

LIX. *g* 10. In a large transparent crystal having the apex of the pyramid bevelled so as to form a trihedral pyramid with rhombic faces, enclosing crystals of prismatic quartz coloured green by chlorite. *Dauphiné.*

*R. de L. Pl. 4. Fig. 27.*

LX.

LX. g 11. In crystals of a topaz colour, and of the same figure, on calcareous spar and galena. *Derbyshire.*

LXI. g 12. In lengthened transparent hexhedral prisms, terminated by hexhedral pyramids, implanted on a group of pyramidal quartz. *Cumberland.*

LXII. g 13. The same, in detached crystals. *Same place.*

LXIII. g 14. The same, in larger aggregated crystals, on semitransparent crystallised quartz.

*R. de L. Pl. 4. Fig. 30.*

LXIV. g 15. The same, in smaller crystals, many of which are of a reddish tinge, on carbonate of lime with galena. *Same place.*

LXV. g 16. In transparent hexhedral crystals, terminated by hexhedral pyramids bevelled at their summits, on greyish calcareous spar. *Same place.*

*R. de L. Pl. 4. Fig. 36.*

LXVI. g 17. In large transparent hexhedral crystals more deeply truncated at their summits, with brown blende. *Same place.*

LXVII. g 18. In fasciculated transparent crystals, with yellowish brown pearl spar. *Fribourg in Brisgau.*

LXVIII. g 19. The same, of a white colour, more minutely crystallised, with iridescent yellow copper ore. *Hartz.*

LXIX. g 20. The same, of a dark smoke grey colour. *France.*

LXX. g 21. In larger fasciculated crystals, also of a smoke grey colour, on a mixture of kupfernickel and grey cobalt ore. *Freyberg, Saxony.*

LXXI. g 22. Minutely crystallised and of a dull white colour, on cubic galena. *Same place.*

LXXII. g 23. In semitransparent diverging fasciculi, on grey argillite. *Haff.*

LXXIII. g 24. The same crystallised more confusedly. *Same place.*

LXXIV.

LXXIV. *b. 1.* In lenticular crystals of a dull white colour. *Andreasberg, Hartz.*  
*R. de L. Pl. 4. Fig. 64.*

LXXV. *i. 1.* In long tetrahedral rhomboidal columns, composed of semitransparent rhomboidal laminæ, the projecting edges of which render the sides uneven. *Same place.*

LXXVI. *i. 2.* In white capillary crystals, on white quartz intermixed with black blende. *Schemnitz, Hungary.*

LXXVII. *i. 3.* The same, forming an incrustation covered on the surface by minute transparent acute pyramidal crystals. *Same place.*

LXXVIII. *i. 4.* Confusedly crystallised, of a white colour and scaly texture, having a cauliflower-like appearance on the surface. *Same place.*

LXXIX. *i. 5.* In semitransparent irregular crystals aggregated into a confused group. *Derbyshire.*

LXXX. *i. 6.* The same, projecting from the surface of a calcareous incrustation. *Same place.*

LXXXI. *i. 7.* The same on the surface of a greyish lime-stone. *Same place.*

LXXXII. *i. 8.* In aggregated crystals, transparent and of a white colour, diverging from the surface of brown spathose iron ore. *Stiria.*

LXXXIII. *i. 9.* The same, of a yellow colour, on brown indurated alumine. *Schemnitz, Hungary.*

LXXXIV. *i. 10.* In opaque filamentous crystals, forming brush-like fasciculi on crystallised quartz. *Same place.*

LXXXV. *i. 11.* In long bristle-like filaments of an obscure yellow colour, on irregular pisolithus. *Italy.*

LXXXVI. *i. 12.* Confusedly crystallised and partially decomposed by ochry calamine, on crystallised quartz. *Schemnitz, Hungary.*

LXXXVII.



LXXXVII. *i* 13. Forming white opaque tuberculi on crystallised quartz with yellow pearl spar. *Same place.*

LXXXVIII. *i* 14. In a confused crystalline mass, composed of semitransparent columns aggregated laterally. *France.*

LXXXIX. *i* 15. In a transparent rhomboidal fragment. (*Duplicating Spar.*) *Iceland.*

XC. *i* 16. The same, of a milky colour at one extremity, with a small portion of galena. *Andreasberg, Hartz.*

XCI. *i* 17. The same, of a pale amethystine colour. *Same place.*

XCII. *i* 18. The same, of a yellowish tinge. *Derbyshire.*

XCIII. *i* 19. Less transparent and of a whitish colour. *Same place.*

## VARIETY II. OF PARTICULAR SHAPES.

*Stalactites, Stalagmites, Flos Ferri, Pisolithus, Roestone, &c.*

In the formation of these substances is strikingly illustrated, not only the influence of the attraction of cohesion, in producing singularity of arrangement, but also of the difference of the menstrual power of water at different temperatures, and the alteration induced in the properties of bodies by a variation in the proportion of their elements.

XCIV. *a* 1. Conical calcareous stalactites, hollow, detached, and of a dull white colour. *Derbyshire.*

XCV. *a* 2. The same, of a snow white colour, aggregated and obscurely crystallised on the surface. *Eisenärzt, Stiria.*

XCVI. *a* 3. Mamillary, and of a brownish yellow colour. *France.*

XCVII. *a* 4. The same, of a snow white colour and semitransparent, on brown spathose iron ore. *Stiria.*

XCVIII. *b* & *c*. Calcareous stalactite, cylindrical and tubular. *Isle of Sky.*  
XCIX.

**LXXX. g 5.** Lentic, spinose, set of a clear colour, on a white calcareous incrustation.  
*Lorraine.*

**C. g 1.** Circular form (see *Fig. 1*), of a snow white colour, and having on the surface a delicate wavy appearance.  
*Stiria.*

**III. g 2.** In ~~small~~ ~~resembling~~ ~~branches~~, ~~inscribed~~ on the surface.  
*Same place.*

**III. g 3.** Irregularly ~~formed~~, ~~inscribed~~ ~~green~~ by oxide of copper.  
*Same place.*

**III. g 4.** In a ~~small~~ ~~resembling~~ ~~of~~ ~~the~~ ~~fibres~~, (*Pyritous*) of a dull ash colour.  
*Welfenbittel.*

**III. g 5.** The same, of a ~~crystalline~~ ~~colour~~.  
*Derbyshire.*

**IV. g 1.** The same, of a yellowish white colour, the spherules composed of concentric layers.  
*Carlsbad, Bohemia.*

**IV. g 2.** Of a brown colour, and composed of smaller spherules, producing the appearance of the set of a fish. (*Simulium*).  
*Geflar, Iceland.*

**IV. g 3.** The same, of a dull white colour and finer grain.  
*Ketton, Northamptonshire.*

**IV. g 4.** The same, of a still finer grain.  
*Bath.*

**CIX. g 1.** Semi-transparent calcareous incrustation, composed of different coloured layers, white, brown, and yellow.  
*Derbyshire.*

**CX. g 2.** Composed of opake layers.  
*Carlsbad, Bohemia.*

**CXI. g 3.** Calcareous incrustation of a pale brownish colour, appearing to have been formed on rock.  
*Derbyshire.*

**CXII. g 4.** The same, opake, porous, of a dull yellowish white colour, with numerous imprecisions of leaves.  
*Italy.*

**CXIII. g 5.** Of a reddish brown colour, covering a branch of thistle. *Carlsbad.*

**CXIV. g 6.** The same, incrusting the oak apple.  
*Same place.*

## VARIETY III. AMORPHOUS.

*Marble, Lime-Stone, Chalk, &c.*

The properties of lime-stone in many instances so exactly correspond with those of marble, that it is often difficult, if not impossible, to distinguish them. The latter may however in general be considered, harder as well as more compact and ponderous than the former. It appears also, by chemical analysis, to contain a larger proportion of alumine and iron, and is therefore so far less fitted for the preparation of lime. They are both found in strata, more or less extensive, constituting a large part of the surface of the globe, and have frequently the remains of organized bodies imbedded in them, more especially those which are of a granular texture.—Like the foregoing substances, they part with their carbonic acid upon the addition of the stronger acids, and by calcination lose nearly one half their weight.

CXV. *a* 1. Brown marble, composed of iridescent shells (*Fire Marble*).

*Bleyberg, Carinthia.*

This marble is found in a stratum of lime-stone, and being very friable when first taken from the mine, can seldom be procured in large pieces. It owes its splendour to portions of the shell of a particular species of *Nautilus*.

CXVI. *b* 1. White coarse grained marble, so hard as to strike fire with steel. *Lapland.*

From the hardness of this marble, it would seem to be analogous to the silicious lime-stone of *Kirwan*, Vol. I. P. 373.

CXVII. *b* 2. Marble, of a grey colour and finer grain.

*Derbyshire.*

CXVIII. *b* 3. The same, of a snow white colour.

*Carrara, Italy.*

In this is contained a slight proportion of quartz and alumine. It loses only  $\frac{1}{1000}$  of its weight at 700° of *Farenheit*. Its specific gravity is 2.716.

*c.* Fibrous.

*d.* Arenaceous.—Analysis.—Acid 47, Lime 53. *Kirwan*

*e.* Slaty.

CXIX. *f* 1. Compact marble of a black colour.

*Derbyshire.*

Marble of this colour frequently contains iron, and sometimes only bitumen, as proved by its becoming white on calcination.

CXX. *f* 2. The same, of a grey colour and ochry on the surface.

*St. Vincent's Rock, Bristol.*

CXXI. *f* 3. The same, of a dull white colour. *Port Russ, Ireland.*

This is a specimen of the white lime-stone mentioned by *Dr. Hamilton* as supporting the basaltic columns on the northern coast of that country. It abounds with fossil remains and nodules of dark flint.

CXXII. *f* 4. The same, of a grey colour, containing the fossil remains of *Entrochæ*.  
*Derbyshire.*

\*CXXII. *f* 5. Of a yellow colour with black arborisations on the surface.  
*Tuscany.*

The dendritic appearance on the surface of this marble is attributed to manganese.

CXXIII. *g* 1. Common chalk. *Kent.*

Analysis.—Acid 42, Lime 53, Alumina 2, Water 3. *Kirw.*

It loses 3 per cent. at 500 of Faren.

*b*. Loofe.

### SPECIES III. SWINE STONE.

*Pierre puante, Fr. Stink-Stein, Germ.*

Analysis.—Carbonate of Lime impregnated by Bitumen.

Though the characteristic property of the varieties of this species, namely their producing an offensive smell when scraped or pounded, has been generally attributed to the presence of petroleum, yet, from the diversity of their odour, and from some which have been examined not yielding any bituminous matter upon distillation, it would seem probable that it may also arise from other causes. This property they lose on being heated, and differ in no other respect materially from marble and lime-stone.

### VARIETY I. AMORPHOUS.

CXXIV. *a* 1. Of a black colour and foliated texture. *Sweden.*

CXXV. *a* 2. The same, productive of a different kind of foetor. *Same place.*

CXXVI. *a* 3. Of a light grey colour and scaly texture, extremely offensive. *Portugal.*

CXXVII. *b* 1. Of a dark brown colour and granular texture. *Namur.*

*c*. Compact.

### SPECIES IV. SIDERO-CALCITE.

*Pearl Spar. Spießstein, Bri. Braunkath, Germ.*

Analysis.—Carbonate of Lime 60, Oxyd of Manganese 35, Iron 5. *Woulfe.*

The

The colours of this spar are various, brown, yellow, grey, white, &c. its surface for the most part splendid; its texture laminated, and the figure of its crystals rhomboidal, specific gravity from 2.39 to 2.83. It effervesces with the stronger acids, becomes darker coloured by long exposure to air, and when heated decrepitates and becomes red, brown or black, according to the proportion of manganese or iron. The quantity of the latter is often such as to render it magnetical. It has been frequently confounded with certain varieties of calcareous spar, with filiceous manganese, and more especially with spathose iron ore, to which it seems in many respects very nearly allied.

#### VARIETY I. CRYSTALLISED.

CXXXVIII. *a 1.* In compressed rhomboidal parallelepipeds of a white colour, on purplish fluor incrustated with brown pearl spar. *Cumberland.*

*R. de L. Pl. 4. Fig. 1.*

CXXXIX. *a 2.* The same, with dodecahedral calcareous spar and cubic fluor.

*Brittany.*

CXXX. *a 3.* The same, of a dark brown colour, with small tubercles of opaque calcareous spar, on white crystallised quartz.

*Schemnitz, Hungary.*

CXXXI. *a 4.* The same, of a white colour, incrustated with minutely crystallised yellow pyrites, on brown spathose iron ore.

*Hortz.*

CXXXII. *a 5.* Forming a minutely crystallised incrustation of a white colour and pearly lustre, on transparent prismatic quartz.

*Cremnitz, Hungary.*

CXXXIII. *a 6.* The same, inclining to a cream colour, on white pyramidal quartz.

*Same place.*

CXXXIV. *a 7.* The same, more minutely crystallised, of a spongy texture internally.

*Schemnitz.*

CXXXV. *a 8.* Forming a thin cellular incrustation of a milk white colour, minutely crystallised on the surface, and partially covered by lenticular calcareous spar.

*Same place.*

CXXXVI. *a 9.* Minutely crystallised, of a cream colour and aggregated into tubercles, on brown cellular pearl spar.

*Northumberland.*

CXXXVII. *a 10.* Forming a partial incrustation of a reddish white colour, with specks of yellow pyrites, on red crystallised quartz.

*Schemnitz, Hungary.*

CLIII. *a* 26. In an irregular cellular mass, of a light liver brown colour. *Hungary.*

CLIV. *a* 27. The same, forming an irregular cavernous incrustation on crystallised amethystine quartz. *Same place.*

## VARIETY II. AMORPHOUS.

*a.* Foliated.

### SPECIES V. BARYTO-CALCITE.

The account given by *Sir T. Bergman* of this stone is, that it is of a dark or light grey colour, and of little transparency; its form either spherical, cuneiform, or crystallised in quadrangular prisms; of a striated texture; that it effervesces with acids, and contains 92 *per cent.* Carbonate of Lime, and 8 Carbonate of Baryt.

## VARIETY I. CRYSTALLISED.

*a.* In tetrahedral prisms.

## VARIETY II. AMORPHOUS.

*a.* Striated.

### SPECIES VI. MURI-CALCITE.

This occurs either in solitary crystals imbedded in talc, steatite, or chlorite; or in an earthy form and of an olive colour; or indurated and amorphous. The colour of the crystals is white, greyish white, pearl-coloured, red or brown. They are semitransparent, rough and shining on the surface, of a laminated texture, and brittle; the figure of their fragments rhomboidal. They possess a greater degree of hardness than calcareous spar, and do not effervesce with acids unless previously reduced to powder. Specific gravity 2.480. In a red heat they lose nearly one half of their weight.

## VARIETY I. CRYSTALLISED.

*Compound Spar. Chaux Magnésée, Fr. Bitter Spath, Germ.*

Analysis.—Carbonate of Lime 52, Carbonate of Magnesia 45, Iron and Manganese 3.  
*Klaproth.*

CLV. *a* 1. In perfect rhomboids of an obscure yellow colour and rough surface, imbedded in pale mountain green chlorite. *Zillartbal, Tyrol.*

## VARIETY

rency, is of a compact sparry texture, very brittle, and of considerable hardness, but not so great as to strike fire with steel. The closeness of its texture renders it susceptible of a fine polish. Its specific gravity varies from 3.09 to 3.19. It undergoes no change upon exposure to air, and is nearly insoluble in water. When pulverized and exposed to a moderate heat, it becomes phosphorescent; but loses this property if it be ignited; and if in the crystalline form it be suddenly exposed to heat, it decrepitates without calcination. It appears to have received its name from the property which it possesses of promoting the fusibility of clay and other earthy substances, though by no means very fusible of itself. *Mr. Scheele* first shewed it to contain, in union with lime, an acid of a particular kind, which may be separated from it by distillation with any of the stronger acids, more especially the sulphuric.

#### VARIETY I. CRYSTALLISED.

Analysis.—Acid 16, Lime 57, Water 27. *Scheele.*

CLVII. *a* 1. In cubic crystals of a sea-green colour, covered on the surface by a thin olive coloured coating, on grey opaque quartz. *Cumberland.*

*R. de L. Pl. 2. Fig. 1 & 2.*

CLVIII. *a* 2. In transparent cubic crystals of a sea-green colour, in black indurated schistus, with brown spathose iron ore underneath. *Same place.*

CLIX. *a* 3. The same, partially covered by crystallised white quartz, and brown spathose iron ore. *Same place.*

CLX. *a* 4. In semitransparent cubic crystals of a light purplish colour, on an aggregated crystallisation of quartz, with laminated ponderous spar. *Lorraine.*

CLXI. *a* 5. The same, of a light yellow colour, with white opaque sulphate of baryt, and white semitransparent arborescent calcareous spar. *Annaberg, Saxony.*

CLXII. *a* 6. Of a pale green colour, covered by pyramidal quartz. *Saxony.*

CLXIII. *a* 7. Of a water colour, with minute crystals of fluor underneath.

*Derbyshire.*

CLXIV. *a* 8. The same, sprinkled on the surface with small grains of yellow copper ore. *Same place.*

CLXV. *a* 9. In semitransparent rectangular parallelepipeds of a muddy water colour, covered in different parts. *Saxony.*

CLXVI.

CLXVI.

d. Earthy.

Analysis.—Acid 28.5, Lime 21, Water 1, Silica 31, Alumina 15.5, Iron 1, Muriatic Acid 1, Phosphoric Acid 1. *Pelletier*.

## SPECIES X. PHOSPHATE OF LIME.

*Appetite, Wern. Phospholite, Kirw.*

This mineral, which was thought to exist only in a crystallised form, has lately been discovered in irregular masses of a laminated texture at *Schleggenwald* in *Bohemia*, and in an earthy form, both in *Hungary* and *Spain*; in the latter country, in strata so extensive as to form entire mountains. When crystallised its colour is various, white, brown, green, red, blue, &c. the form of its crystals truncated hexhedral prisms, laminated in their transverse fracture; their surface shining and longitudinally striated; inferior in hardness to fluor; semitransparent; brittle; specific gravity from 3.098 to 3.218; found generally with tin and fluor.

It dissolves with scarcely any effervescence both in the nitric and muriatic acids. By the sulphuric it is also decomposed, but not so readily on account of the insolubility of the compound produced by the union of this acid with the lime. It phosphoresces in a moderate heat; does not decrepitate when in powder, and is scarcely fusible by the blow-pipe, even with the addition of alkali, microcosmic salt, or borax. *Mr. Klaproth*, to whom we are indebted for its analysis, found it in the crystallised form to contain, Acid 45, Lime 55.

### VARIETY I. CRYSTALLISED.

CXCII. *a* 1. In short hexhedral truncated prisms, semitransparent and of a pale sea-green colour, implanted sideways on a mixture of crystallised tin and mispickel, partially incrustated with brownish yellow talc. *Ehrenfriedersdorf, Saxony.*

CXCIII. *a* 2. The same, in a very short solitary crystal, with crystallised tin and quartz, on steatite. *Same Place.*

CXCIV. *a* 3. In a long solitary crystal of a yellowish colour, with crystallised tin and fluor and pulverulent lithomarga, on grey gneiss. *Same place.*

### VARIETY II. AMORPHOUS.

Analysis.—Acid 34, Lime 59, Silica 2, Fluoric Acid 2.5, Muriatic Acid 0.5, Carbonic Acid 1, Iron 1. *Pellet.*

*a.* Striated.

*b.* Earthy.

SPECIES



## SPECIES XI. SULPHATE OF LIME.

*Gypsum, Selenite. Gypse, Fr. Gips, Germ.*

This compound of lime, like the former, occurs either in a crystallised form, or in irregular masses, for the most part of a white colour, and of a foliated, fibrous, or laminated texture. It is generally so soft as to bear the impression of the nail, and varies in its specific gravity from 1.870 to 2.320. It is soluble in about 500 times its weight of water, at a common temperature. When pure, it does not effervesce with any acid, and is soluble only in the concentrated sulphuric, with the assistance of heat. By calcination, it parts with its water of crystallisation, and is converted into a white powder, which, when mixed with water, has the useful property of becoming concrete. It melts at about 130 of *Wedgewood* in a clay crucible, although incapable of fusing *per se* even in a solar heat. According to *Mr Kitwan*, the easiest method of decomposing it is by boiling it in a solution of carbonate of potash. Though met with in several parts of the world in great abundance, it is considered as posterior in its formation to what are called primitive mountains, which are chiefly composed of granite. In many instances its production is owing obviously to the decomposition of pyritical matter in the neighbourhood of other calcareous substances, more especially carbonate of lime; striking examples of which are found at *Shotover-Hill* in *Oxfordshire*.

## VARIETY I. CRYSTALLISED.

Analysis.—Acid 46, Lime 32, Water 22. *Berg.*

CXCV. *a* 1. In detached transparent rhomboidal decahedral crystals. *Shotover-Hill.*  
*R. de L. Pl. 5. Fig. 28.*

CXCVI. *a* 2. A large solitary crystal of the same. *Simma, Italy.*

CXCVII. *a* 3. In smaller transparent aggregated crystals, on snow white granular gypsum. *Derbyshire.*

CXCVIII. *a* 4. In large semitransparent crystals, with a curvilinear truncation of their acute angles. *Shotover-Hill.*

CXCIX. *a* 5. In aggregated hexhedral prisms with curvilinear indeterminate summits. *Same place.*  
*R. de L. Pl. 5. Fig. 32.*

CC. *a* 6. In long and slender prisms, with an ochry incrustation, on a matrix of the same. *Upper Hungary.*  
*R. de L. Pl. 5. Fig. 37.*

- CCI. *a* 7. In slender transparent prismatic crystals, on native sulphur. *Italy.*
- CCII. *a* 8. The same, with oblique dihedral summits having equal faces, on white crystallised quartz. *Schemnitz, Hungary.*  
*R. de Pl. 5. Fig. 40.*
- CCIII. *a* 9. The same, in numerous and more slender crystals, with black clay and white quartz. *Lententhal, Hartz.*
- CCIV. *a* 10. In large colourless hexhedral prisms, terminated by tetrahedral pyramids with unequal faces, lying in different directions on brownish indurated clay. *Salt Mines, Cheshire.*  
*R. de L. Pl. 5. Fig. 38.*
- CCV. *a* 11. In smaller crystals of a yellowish colour closely interwoven, being formed in a narrow fissure. *Hartz.*  
*R. de L. Pl. 5. Fig. 39.*
- CCVI. *a* 12. In large transparent aggregated crystals of the same figure. *Bavaria.*
- CCVII. *a* 13. In flattened transparent prisms, some with tetrahedral, others with bifurcated summits, on black saline indurated clay. *Hall, Tyrol.*  
*R. de L. Pl. 5. Fig. 40.*
- CCVIII. *a* 14. In delicate transparent prismatic crystals with oblique summits, grouped in diverging fasciculi, on greyish lime-stone. *Derbyshire.*
- CCIX. *b* 1. In semitransparent lenticular crystals, on amorphous ferruginous gypsum. *Oxfordshire.*  
*R. de L. Pl. 5. Fig. 33.*
- CCX. *b* 2. In broader lenticular crystals of a pale yellowish brown colour, with whitish clay in the interstices. *Mont Martre.*
- CCXI. *b* 3. In large semitransparent aggregated angular fragments of a brownish yellow colour, (*Arrow-beaded Gypsum*). *Same place.*
- CCXII. *c* 1. In striated crystals of a yellow colour, lying confusedly on ash-coloured indurated clay.
- CCXIII. *c* 2. In white laminated diverging crystals, on ash coloured indurated clay inclosing a vein of black scaly blende. *Same place.*
- CCXIV. *c* 3. In smaller and more numerous crystals, on the surface of grey indurated clay intermixed with muriate of soda. *Salzburg.*
- CCXV.

CCXV. c 4. In flatted prismatic crystals, diverging from a common centre and producing a stellated appearance, on a fragment of yellow septarium. *Isle of Sheppy, Kent.*

CCXVI. c 5. In loose filaments of a snow white colour. *Derbyshire.*

VARIETY II. IN PARTICULAR SHAPES.

CCXVII. a 1. Forming a snow white incrustation, with projecting contorted branches, on ash-coloured lime-stone. *Matlock.*

VARIETY III. AMORPHOUS.

CCXVIII. a 1. In a transparent quadrangular plate of a laminated texture, composed of broad transparent folia.

CCXIX. a 2. Laminated and transparent, with yellow copper ore. *Torda, Transylvania.*

CCXX. a 3. The same, less transparent and of a grey colour. *Hartz.*

CCXXI. a 4. The same, with a white efflorescence on the surface, probably arising from calcination. *Salzburg.*

CCXXII. a 5. In an irregular piece, of a grey colour, having the laminæ applied to each other in a zigzag direction. *Mount Corcyra, Italy.*

CCXXIII. b 1. In an irregular piece, of a grey colour, granular and somewhat filamentous. *Hartz.*

CCXXIV. b 2. Of a granular texture, translucent and of a snow white colour. *Derbyshire.*

CCXXV. b 3. Granular, of a spongy texture, opaque and of a red colour. *Brittany.*

CCXXVI. c 1. } In a lengthened piece composed of parallel shining fibres or striæ,  
d 1. } translucent and snow white. *Derbyshire.*

CCXXVII. e 1. In a quadrangular tablet, compact, and of a milk white colour. *Same place.*

CCXXVIII.

CCXXVIII. *c* 2. In a flatted piece, semitransparent, and of a dull white colour, with native sulphur on the surface. *Spain.*

CCXXIX. *c* 3. Forming an irregular cellular incrustation of a yellowish colour. *Herregrund, Hungary.*

*f.* Farinaceous.

## GENUS II. STRONTIAN.

The most correct account of this earth is given by *Mr. Kirwan*, from which it would appear, that its properties are intermediate between those of lime and baryt. When freed by calcination from its union with carbonic acid, it is found to be soluble in 200 parts of water at a temperature of 60°, and to possess the remarkable property of separating from a saturated solution in the form of rhomboidal crystals. It dissolves readily in the nitric and muriatic acids, and decomposes, in the moist way, all the saline compounds of the sulphuric, with which it forms an insoluble precipitate. It promotes the fusibility of most of the other earths. Its affinities seem to be superior to those of lime, but inferior to baryt. This earth has been hitherto only found in combination with carbonic acid in *Scotland*, at *Strontian*, from whence it has received its name.

### SPECIES I. CARBONATE OF STRONTIAN.

*Strontianite. Kirw.*

The colour of this is whitish or light green, with a moderate degree of lustre. Its transparency intermediate between the semitransparent and opaque. Its fracture striated, presenting oblong distinct concretions, somewhat uneven and bent. Its hardness moderate, being easily scraped; but very brittle. Its specific gravity from 3.4 to 3.644. It loses in calcination more than 20 *per cent.* of its weight; and dissolves with considerable effervescence both in the muriatic and diluted nitric acids.

Analysis.—Acid 26.5, Strontian 73.5. *Kirw.*

### VARIETY I. AMORPHOUS.

I. *a* 1. Composed of long striæ of a dull yellowish green colour, diverging from different centres, with whitish baroselenite. *Strontian,*

II. *a* 2. The same, of a greenish white colour.

*Same place.*

GENUS

GENUS III. *BARYT.**Schwererde, Germ.*

In the separate state, to which this earth may be reduced by the application of a strong heat to artificially prepared carbonate of baryt, its form is pulverulent, its colour white, taste somewhat pungent, specific gravity 400. It is soluble in about 900 times its weight of water, and communicates to it properties analogous to those of lime-water. It is infusible *per se*, though affected by the usual fluxes in the same manner as lime. The compound which it forms with sulphuric acid is nearly insoluble, requiring for its solution 40,000 times its weight of water. With the nitric and muriatic acids, it forms crystallisable salts. It unites with sulphur into a particular species of hepar, and is remarkable for the violent effects which it produces upon the living body when exhibited internally, which is found also to be the case with all the saline forms of this earth.

SPECIES I. *CARBONATE OF BARYT.**Barolite, Kirw. Witherite, Wern.*

It is found either crystallised or in solid masses, semitransparent, and of a striated or compact texture, the striæ for the most part diverging. Its colour either greyish white, or milk white, with moderate lustre, and having sometimes a slight tinge of yellow. It may be pretty easily scraped with the knife. Its specific gravity is from 4.3 to 4.33. It is soluble, with effervescence, both in the nitric and muriatic acids, and in the concentrated sulphuric in a strong heat. It loses its transparency when heated, but does not part with its carbonic acid, nor melt even in the most intense degree of heat.

It was first analysed by *Dr. Withering*, who found it to contain of carbonic acid 20.8, baryt 78.6.

VARIETY I. *CRYSTALLISED.*

a. In hexhedral pyramids, joined base to base.

I. b 1. In hexhedral prismatic crystals, of a dull white colour, terminated by hexhedral pyramids; lining a cavity in a compact mass of the same interspersed with yellow pyrites.

*Anglefark near Chorley, Lancashire.*

## VARIETY

## VARIETY II. AMORPHOUS.

II. *a 1.* Of a fibrous texture, semitransparent, and of a water colour, the fibres running nearly parallel, and having one side covered by a cellular ochry incrustation.

*Same place.*

III. *a 2.* The same, composed of fibres diverging from different centres and without incrustation.

*Same place.*

*b.* Foliated.

IV. *c 1.* Of a compact texture, with white opaque sulphate of baryt, and yellow sulphuret of iron.

## SPECIES II. SULPHATE OF BARYT.

*Barofelenite. Ponderous Spar. Spath Pesant, Fr. Schwerspath, Germ.*

This is also found crystallised or amorphous. When crystallised, it is for the most part more or less transparent, and of a laminated texture. Its colour generally white, flesh red, ochry yellow or grey. Its lustre and hardness nearly the same with those of carbonate of baryt. Specific gravity when pure 4.865. It requires for its solution 43,000 times its weight of water. It is soluble in the concentrated sulphuric acid with the assistance of heat, but precipitates from it on the addition of water. When suddenly heated, it decrepitates like calcareous spar, and may be melted by an intense heat into a coloured glass. It melts also with soda, borax, and microcosmic salt; in the two latter instances with scarcely any effervescence. If calcined in the open fire, in contact with the fuel, it acquires the property of being luminous in the dark. It occurs frequently in metallic mines, in veins or nodules, and has also been discovered as a constituent part of certain compounded rocks.

## VARIETY I. CRYSTALLISED.

Analysis.—Acid 32.8, Baryt 67.2. *Wüßering.*

V. *a 1.* In aggregated lengthened octohedrons with cuneiform summits, semitransparent and of a water colour intermixed with red.

*Freyberg, Saxony.*

*R. de L. Pl. 3. Fig. 53.*

VI. *a 2.* In octohedrons, of a pale yellow colour, having their pyramids deeply truncated, implanted on cubic galena.

*Brittany.*

*R. de L. Pl. 3. Fig. 57.*

VII.

VII. *a* 3. In thin white semitransparent crystals, of the same figure with the former, united by an oblique application of their faces into a laminated mass, with their edges projecting on the surface.

*Hartz.*

*R. de L. Tom. 3. P. 591.*

VIII. *a* 4. In larger and very deeply truncated crystals, somewhat ochry on the surface, and more projecting, attached to brown spathose iron ore, with large specks of yellow sulphuret of iron.

*Same place.*

IX. *a* 5. The same, of a darker colour, having the position of the superficial crystals more diversified, with pyramidal calcareous spar and crystallised yellow copper ore.

*Freyberg, Saxony.*

X. *a* 6. In semitransparent colourless crystals, bevelled both at their edges and angles.

*R. de L. Pl. 3. Fig. 67.*

*Dove Town Mine, Cumberland.*

XI. *a* 7. The same, in very large transparent colourless quadrangular tabular crystals, bevelled at their angles and edges of their extremities.

*Same place.*

XII. *a* 8. A solitary crystal of the same.

*Same place.*

XIII. *a* 9. The same, small, transparent, and colourless, on indurated ferruginous clay, intermixed with grey quartz.

*Marienberg, Saxony.*

XIV. *a* 10. In transparent plated rhomboidal crystals, bevelled at their obtuse angles, and imbricated or lying over each other in the manner of tiles.

*Same place.*

*R. de L. Pl. 3. Fig. 75.*

XV. *a* 11. In semitransparent flated projecting hexhedral crystals, with acute didedral summits, having a smoky appearance on the surface.

*Felsobanya, Upper Hungary.*

*R. de L. Pl. 3. Fig. 61.*

XVI. *a* 12. In large tabular rhombic crystals, semitransparent, of a greyish colour, mortified into each other in various directions, and having a downy covering of plumose antimonial ore, with numerous minute crystals of white opake quartz.

*R. de L. Pl. 3. Fig. 71.*

*Felsobanya, Upper Hungary.*

XVII. *a* 13. The same, in smaller crystals, transparent in the middle, but opake and of an ivory colour at the edges, on yellow iron pyrites intermixed with galena, the pyrites incrusting many of the crystals.

*Brittany.*

XVIII. *a* 14. In thin rhomboidal crystals, semitransparent, and of a yellowish colour, forming an irregular group without matrix.

*Cremnitz, Hungary.*

F

XIX.



XIX. *a* 15. In smaller semitransparent crystals, on white crystallised quartz.

*Same place.*

XX. *a* 16. In still smaller and more transparent rhombic crystals, on white spongy quartz.

*Same place.*

XXI. *a* 17. In aggregated tetrahedral crystals, transparent and almost colourless, truncated at both extremities, on amorphous baroselenite.

*Durham.*

XXII. *a* 18. In thin hexhedral tabular crystals, semitransparent and of a pearly grey colour, attached to each other in clusters, on crystallised quartz, covered by a minutely crystallised ferruginous quartz incrustation.

*Schemnitz, Hungary.*

*R. de L. Pl. 3. Fig. 73.*

XXIII. *a* 19. The same, in broader crystals of the same figure, less aggregated and of an ochry appearance.

*Same place.*

XXIV. *a* 20. In numerous semitransparent tabular crystals of a whitish colour, on a mixture of blende and galena.

*Cremnitz, Hungary.*

XXV. *a* 21. The same, in broader crystals, with a cream coloured quartz incrustation, on greyish crystallised quartz intermixed with brown blende.

*Same place.*

XXVI. *a* 22. In flatted prismatic hexhedral crystals, truncated at their extremities, internally semitransparent and of a water colour, opaque and of a dull white colour on the surface, on whitish quartz incrustated with yellow pyrites.

*Schemnitz, Hungary.*

XXVII. *a* 23. The same, on the surface of ferruginous quartz, intermixed with yellow sulphuret of copper.

*Same place.*

XXVIII. *b* 1. In white striated prismatic crystals, intricately interwoven and coloured on the surface by yellow ochre, on spongy quartz.

*Freyberg, Saxony.*

*Catal. de Raab. Tom. II. D. b. 10.*

From the appearance of this variety, it has been often mistaken for white spathose lead ore.

*c.* Lenticular.

XXIX. *d* 1. In very minute transparent crystals, on cream coloured hollow ramose stalactites of the same.

*Hartz.*

XXX. *d* 2. The same, on stalactitical baroselenite, of a pale flesh colour, irregularly cylindrical and of a cellular texture.

*Same place.*

XXXI.



XXXI. *d* 3. In confusedly aggregated crystals of a dull white colour, having a cock's comb appearance on the surface, with yellow pyrites and dodecahedral calcareous spar.  
*Annaberg, Saxony.*

XXXII. *d* 4. The same, of a reddish white colour, with small tubercles of sulphuret of iron on the surface.  
*Hartz.*

XXXIII. *d* 5. The same, of a paler colour with more numerous tubercles of pyrites.  
*George Tufenstolln.*

XXXIV. *d* 6. The same, in a flatted piece, of a pale flesh red colour, without pyrites.  
*Same place.*

XXXV. *d* 7. The same, internally white, externally ochry and more scabrous, with calcareous spar on the surface.  
*Brittany.*

XXXVI. *d* 8. The same, of a cream colour, without calcareous spar. *Derbyshire.*

XXXVII. *d* 9. The same, of a flesh red colour, with quartz and black blende.  
*Auvergne.*

XXXVIII. *d* 10. Of a yellowish white colour, transparent, arborefcnt on the surface, and of a spongy texture.  
*Anglefark, near Chorley, Lancashire.*

XXXIX. *d* 11. Of a light ash colour, and tuberous on the surface, with crystallised calcareous spar.  
*Freyberg, Saxony.*

XL. *d* 12. In a flat, semitransparent, rhomboidal, crystalline fragment. *Same place.*

XLI. *d* 13. The same, less transparent and of a more irregular figure. *Auvergne.*

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Stalactitic. *Vide* No. XXX.

*b.* Tubuliform, &c. *Vide* No. XXIX.

## VARIETY III. AMORPHOUS.

*a.* Foliated. *Vide* No. XL. and XLI.

XLII. *b* 1. Of a dark grey colour, internally striated, and having a penniform appearance.  
*Scotland.*

- XLIII. *b* 2. In a flatted spherical nodule, of a grey colour. (*Bolognian Stone*.)  
*Mount Paterno, Bologne, Italy.*

The property of becoming luminous in the dark, being first observed in this variety of baroselenite, it has therefore when calcined been called *Bolognian Phosphorus*. It has been analysed by *Mr. Arvidson*, and found to contain Sulphate of Baryt 62, Silica 16, Alumina 15, Sulphate of Lime 6, Water 2.

- XLIV. *b* 3. Of a yellowish ash colour, opaque, irregular, and fasciculated in its structure.  
*Derbyshire.*

- XLV. *c* 1. Of a compact texture, with veins of galena, artificially polished.  
*Same place.*

- XLVI. *c* 2. Of a brownish colour and veined, also cut and polished. *Same place.*

- XLVII. *d* 1. In an irregular mass, of an ash colour and earthy texture (*Cawk*).  
*Same place.*

- XLVIII. *d* 2. Of a lighter colour intermixed with red.  
*Andalusia, Spain.*

The phosphorescent property of this variety is such, that upon simple friction it becomes luminous in the dark, and remarkably so if exposed to a low red heat, the luminous appearance very much resembling that which is exhibited by common phosphorus.

### SPECIES III. LIVER-STONE.

*Liberstein, Germ.*

A stone which emits a smell of liver of sulphur when rubbed or heated to redness, of a grey, yellowish grey, brown, or greyish black colour, with some lustre and but little transparency; of a foliated and partly striated texture, and of considerable hardness. Specific gravity 2.666. It does not effervesce with acids. It is found in *Andrarum* in *Scania*, and contains, according to *Bergman's* analysis, Sulphate of Baryt 38, Silica 33, Sulphate of Alumina 22, Sulphate of Lime 7, Petroleum 5.

### VARIETY I. AMORPHOUS.

- a.* Foliated.
- b.* Striated.

### GENUS

GENUS IV. *MAGNESIA.**Talkerde, Germ.*

The purest magnesia is that which is prepared artificially from the decomposition of sulphate of magnesia by either of the fixed alkalis; or by carbonate of ammoniac, and subsequent calcination. When free from foreign admixture it assumes the form of a light, pure white, insipid powder. Its specific gravity about 2.3. It requires for its solution 7.900 times its weight of water. It is infusible without addition, even in the most intense degrees of heat, but melts into a glass with lime, microcosmic salt, or borax. It unites with all the acids and may be combined in small proportions with sulphur. It has long been employed as an antacid and laxative in disorders of the *primæ viæ*; and, in the form of steatite, is a principal ingredient in the preparation of the finer kinds of porcelain. Magnesia has not as yet, in any instance, been met with in an uncombined state.

SPECIES I. *CALCI-MURITE.*

Magnesia mixed with a notable proportion of Calcareous Earth and some Oxyd of Iron.

*Kirw.*

It is described as of the consistence of clay, and of a blue or olive green colour. The green contains no alumine, but merely lime and magnesia tinged by iron; the blue has a larger quantity of lime, and is used in pottery. They are both found near *Thionville*.

VARIETY I. *AMORPHOUS.*

a. Earthy.

SPECIES II. *ARGILLO-MURITE.*

Carbonate of magnesia mixed with alumine and oxyd of iron.

Found either of a greenish colour and earthy texture in *Silesia*; or of a farinaceous consistence in *Italy*, where it has been analysed by *Mr. Fabroni*, who found it to consist of Magnesia 13, Silica 50, Alumine 10, Lime 3, Oxyd of Iron 0.9, Water 12. Of this the ancients made bricks so light as to float on water.

VARIETY I. *AMORPHOUS.*

a. Earthy.

b. Loose.

SPECIES

SPECIES III. *SILICI-MURITE.*

This is found either of a hard, solid, and sparry texture, and of a grey, or ochry yellow colour (*Martial Muriatric Spar, Kirw.*), or plastic, and of a yellow colour when recently dug (*Keffekill, Meerfchaum*). The first is so hard as to strike with steel. It effervesces with acids, and melts in a strong heat. 100 parts of it are said to contain 50 of Silex, with carbonate of Magnesia and Iron. The latter is the substance of which the large Turkey pipes are formed, by boiling it in oil, and subsequent exposure to air. By a very intense heat it may be converted into a white porcelain mass. *Baron Born* considers it as semitransparent talc (*Catal. de Raab. Tom. 1. P. 244*). By *Mr. Weigleb's* analysis it contains equal parts of magnesia and silic.

VARIETY I. *AMORPHOUS.*

a. Foliated.

I. b 1. In a white mass of an earthy texture (*Spuma Maris*). *Burza, Lower Turkey.*

SPECIES IV. *TALC.*

This is met with either of a foliated, flaty, or scaly texture, and of a white, greenish, yellowish, or reddish white, or greyish green colour, with somewhat of a metallic lustre. It is for the most part more or less transparent, of a moderate hardness, and is unctuous to the feel. It does not effervesce with acids. The purer sorts when strongly heated, become whiter, less transparent, and more brittle. By an intense heat it melts into an opaque greenish mass, spotted slightly with red. It fluxes with difficulty with the fixed alkalis, but more readily with microcosmic salt and borax.

VARIETY I. *AMORPHOUS.*

II. a 1. Composed of broad, shining, flexible folia, closely compacted and of a greenish white colour. (*Venetian Talc.*) *Zillertal, Tyrol.*

This, from being of a white colour when reduced to powder, and leaving a beautiful polish on the skin, has long been employed as a cosmetic. *Mr. Hæpfner* found it to contain Magnesia 44, Silic 50, Alumine 6.

III. a 2. The same, on the surface of semitransparent felspar of a pale reddish white colour and shining fracture.

*Same place.*

IV.

IV. *a 3*. A polished slab of the same, of a pale green colour and intermixed with shining silvery laminæ. *Scotland.*

V. *b 1*. Of a slaty texture and greenish white colour. (*Schistose Talc.*) *Bareuth.*

VI. *b 2*. The same, of a duller colour, and somewhat more compacted. *Hungary.*

VII. *b 3*. The same, more indurated and of a shining yellowish grey colour. *Zillertal, Tyrol.*

VIII. *b 4*. In thin undulating laminæ, of a dark greenish grey colour. *Fahlun, Sweden.*

IX. *b 5*. The same, of a divergingly striated texture and dark grey colour. *Scotland.*

X. *c 1*. Composed of small compacted scales (*Talcite*) of a white colour and silvery lustre, inclosing prismatic crystals of green quartz. *Dauphiné.*

#### SPECIES V. LAPIS OLLARIS.

*Pot Stone. Pierre Ollaire, Fr. Topfstein, Germ.*

Of a greenish, reddish, or yellowish grey colour, and foliated or slaty texture; nearly or altogether opaque, having little lustre; of moderate hardness and somewhat unctuous feel. The specific gravity of the most perfect kind, 2.872. It becomes white by calcination, and acquires sufficient hardness to strike fire with steel. It takes its name from the capability which it possesses of being turned upon the lathe into vessels, which have been long in use in *Switzerland* and other parts of the world.

#### VARIETY I. AMORPHOUS.

XI. *a 1*. In a quadrangular slab, of a foliated texture and greenish grey colour. *Como, Milan.*

Analysis.—Magnesia 38, Silica 38, Alumina 7, Iron 5, Carbonate of Lime 1, and a trace of Fluoric Acid. *Weigl.*

\*XI. *b 1*. In an irregular piece, of a granularly foliated texture and grey colour. *Mont Musate, Italy.*

#### SPECIES

SPECIES VI. *STEATITES.*

*Soap-Rock. Pierre de Lard, Fr. Speckstein, Germ.*

The properties of this are in many respects analogous to those of the two foregoing species. Though sometimes crystallised, it occurs, for the most part, in irregular masses or veins, of a white, yellowish, greenish, reddish, or grey colour, often streaked or spotted, and of different degrees of induration, being in some instances so soft as to yield easily to the nail, in others, nearly as hard as serpentine. Its texture generally compact, often of a somewhat splintery fracture. In most instances unctuous to the feel; sometimes slightly transparent, and varying in its specific gravity from 2.4 to 2.7. It has more or less of an earthy smell when breathed on; but does not adhere to the tongue. The principal chemical difference between this and pot-stone seems to be, that it contains a smaller proportion of silicic acid and magnesia, as well as a smaller proportion of iron.

VARIETY I. *CRYSTALLISED.*

- a. In cubes, truncated at their angles.
- b. In hexahedral prisms.
- c. In octohedral prisms, truncated.

VARIETY II. *AMORPHOUS.*

- a. Foliated.
- b. Striated.

XII. c 1. Compact, indurated and of a greenish grey colour. *Briançon, France.*

XIII. c 2. Indurated, and of a pale rose red colour. *Saxony.*

XIV. c 3. The same, of a pistachio green colour. *Durham.*

XV. c 4. Semi-indurated, and of a dull white colour with black dendretic figures. *Saxony.*

Analysis.—Magnesia 20.84. Silicic acid 48.42. Alumina 14. Iron 1. Air and Water 16.  
*Klapr.*

XVI.

XVI. c 5. Of a dull white colour and soapy texture. *Cornwall.*

At the Lizard in Cornwall, many of the neighbouring inhabitants are constantly employed in collecting this kind of steatite, for the use of the potteries in *Staffordshire*.

XVII. c 6. The same, of a mottled appearance. *Same place.*

XVIII. c 7. More indurated and less unctuous. *Same place.*

XIX. c 8. Indurated, semitransparent, and of a greenish white colour. *East Indies.*

XX. c 9. Very much indurated, semitransparent, and of a chocolate brown colour, intermixed with pearly grey. *China.*

XXI. c 10. Indurated, of a dark asparagus green colour, intermixed with dull white. *Saxony.*

XXII. c 11. Indurated, of a pale green colour, marked by two black lines intersecting each other. *France.*

XXIII. c 12. Three varieties of indurated steatite, carved into figures. *China.*

XXIV. c 13. Indurated, approaching to the nature of serpentine, of a dark green colour, coated by dark leek green chlorite. *Silesia.*

#### SPECIES VII. SERPENTINE.

This stone is commonly of a greenish, yellowish, reddish, or greyish colour, with green or red spots, veins or clouds. Its fracture earthy, granular, or scaly; of considerable hardness and somewhat brittle; without lustre, and having little or no transparency. Its specific gravity from 2.40 to 2.60. It has in most instances an earthy smell when breathed on, and feels somewhat unctuous. When heated, it hardens and becomes red, but is infusible by the blow-pipe. It occurs most commonly in amorphous masses, seldom intermixed with other substances. The green colour of serpentine is suspected by *Mr. Klaproth* to be derived from *Nickel*.

Analysis.—Magnesia 33, Silica 45, Magnetic Iron 14, Carbonate of Lime 6.25, Alumina 0.25, with a little Muriate of Magnesia and Water. *Knock.*

XXV. a 1. Of a slaty texture, and pale mountain-green colour, coating dark leek green serpentine. *Zöplitz, Saxony.*

XXVI. a 2. The same, of a more compact texture and greenish colour. *Same place.*

XXVII. *a* 3. Thirteen varieties of polished serpentine, of various colours, from Scotland, Saxony, Italy, and other parts.

### SPECIES VIII. CHLORITE.

*Terre Talquense Verdâtre, BORN.*

Found either crystallised, or indurated and amorphous, or in loose scales. Its colour grafs green or greenish brown, or dark green inclining to black. The indurated is of an earthy, somewhat scaly or slaty texture, opaque, with but little lustre; of moderate hardness and not remarkably heavy. It does not effervesce with acids. The loose gives an earthy smell when breathed on. It melts into a dull black compact slag, and then becomes magnetic. By the analysis of *Mr. Hapfner* it contains Magnesia 0.3947, Silica 0.415, Alumina 0.0613, Lime 0.015, Iron 0.1015, Air and Water 0.015. The indurated contains somewhat less Magnesia and more Silica.

#### VARIETY I. CRYSTALLISED.

*a*. In tetrahedral prisms.

#### VARIETY II. AMORPHOUS.

XXVIII. *a* 1. Indurated, of a slaty texture and dark mountain-green colour.

*Corfica.*

XXIX. *a* 2. The same, inclosing crystals of black schorl and pale flesh red felspar.

*Zillertal, Tyrol.*

XXX. *a* 3. The same, thickly interspersed with garnets.

*Scotland.*

XXXI. *b* 1. Indurated and of an earthy texture and dark mountain-green colour, interspersed with minute crystals of spathose iron ore.

*Cornwall.*

XXXII. *b* 2. The same, of a pale verdegis-green colour.

*Aberdeenshire.*

XXXIII. *c* 1. In small scales slightly cohering, of a pale mountain-green colour.

*Scotland.*

### SPECIES IX. ASBESTOS.

*Asbeste non mure, Fr.*

Is of a fibrous, or striated texture, the fibres for the most part parallel, though often curved and diverging. It is generally of a leek or olive green colour, more rarely yellowish grey, and sometimes greenish white. Its hardness such, that it yields with difficulty to the knife; not brittle; fragments splintery; feels somewhat unctuous to the touch;

specific



specific gravity about 2.547. It does not effervesce with acids, and fuses with great difficulty. From the experiments of *Bergman* and others, it appears to consist principally of Silica combined with Carbonate of Magnesia.

#### VARIETY I. AMORPHOUS.

XXXIV. *a* 1. Of a striated compact texture and dark green colour, having one side polished. *Scotland.*

XXXV. *a* 2. The same, of a lighter green colour. *Danemora, Sweden.*

This probably is of the same kind with that from *Bafnas, Grufva*, analysed by *Bergman*, and found to contain Carbonate of Magnesia 16, Silica 63.9, Carbonate of Lime 12.8, Alumina 1.1, Oxide of Iron 6.

*b* Fibrous.

XXXVI. *c* 1. Of a flaty compact texture, and brownish green colour, inclining to yellow. *Scotland.*

XXXVII. *c* 2. Of a lighter yellowish green colour, having a more silky appearance on the surface. *Same place.*

#### SPECIES X. AMIANTHUS.

This is also of a fibrous structure, and sometimes of an olive or mountain green colour, though most commonly of a greyish or greenish white; more rarely yellowish or silvery white. It is likewise occasionally met with of a pale flesh-red, or ochry yellow colour. It differs principally from asbestos in being composed of fibres which are flexible, whilst those of the former are rigid and oftener incurved, and in being more easily fused. It is besides of less specific gravity, and inferior to asbestos in point of hardness. In many instances, however, the sensible as well as chemical properties of these bodies are so similar, that it is difficult if not impossible to distinguish them with accuracy.

#### VARIETY I. CRYSTALLISED.

*a*. In compressed rhomboidal parallelepipeds.

In this form amianthus has been said to be found near *Bagnères* of a grey or bluish colour, and at first of a soft and filamentous texture, but hardening on exposure to the air. *Vide 26 Rozier Journal de Physique 429.*

## VARIETY II. AMORPHOUS.

XXXVIII. *a* 1. In long flexible cotton-like filaments slightly cohering, and of a dull white colour, on greenish schistus. *Pyrenees.*

XXXIX. *a* 2. In broad and soft shining laminæ, of a reddish cinnamon colour, on greyish indurated schistus. *Dauphiné.*

XL. *a* 3. Of a fibrous texture and dark reddish brown colour. *Pyrenees.*

XLI. *a* 4. In white and very minute filaments slightly cohering. *Same place.*

XLII. *a* 5. In loose white silky filaments. *Tarentaise, Savoy.*

This kind, according to the analysis of *Bergman*, contains Silex 64, Carbonate of Magnesia 18.6, Carbonate of Lime 6.9, Sulphate of Baryt 6, Alumine 3.3, Oxyd of Iron 1.2.

XLIII. *a* 6. Of a fibrous cottony texture and dull white colour, on coarse schistose talc. *Dauphiné.*

XLIV. *a* 7. The same, of a yellowish colour, on greenish grey indurated schistus: *Pyrenees.*

XLV. *a* 8. The same, artificially matted. *Same place.*

XLVI. *a* 9. Various specimens of wrought amianthus. *Alps.*

For the manner in which these are manufactured; the advantage taken of their incombuftibility by the ancients to collect the ashes of their kings; the use of amianthine napkins; the construction of perpetual wicks for lamps, &c. See *Waller Syst. Min. Tom. I. Pag. 409.*

XLVII. *a* 10. Of a thread-like appearance and dull white colour, on whitish indurated clay. *Alps.*

XLVIII. *a* 11. In lengthened pieces composed of very long thread-like filaments of a light greenish white colour. *Alps.*

XLIX. *a* 12. In short fibres of a greenish white colour and silky lustre, forming veins in green serpentine. *Anglesea.*

*b.* Farinaceous.

## SPECIES

SPECIES XI. *SUBER MONTANUM*.*Mountain Cork. Liege de Montagne, Fr. Bergkork, Germ.*

This is met with in irregular pieces of different colours, white, yellow, brown, green, blue, or grey. It varies considerably in texture, being either cork-like, spongy, or membranaceous. It is generally so light as to swim on water. It is meagre to the feel, somewhat elastic, of little hardness, seldom of any lustre, and always opaque. Its specific gravity (according to *Briffon*) is, when dry, from 0.68 to 0.99, but when moist, from 1.24, to 1.34. It does not effervesce with acids, except by the assistance of heat, and is very difficult of fusion. By *Bergman's* analysis it contains Carbonate of Magnesia 22, Silica 62, Alumina 2.8, Carbonate of Lime 10, and Oxide of Iron 3.2.

VARIETY I. *AMORPHOUS*.

L. *a* 1. In a light irregular nodule of a sky blue colour. *Persia.*

LI. *b* 1. Of a spongy texture, and dull yellowish white colour. *Bohemia.*

LII. *b* 2. More compact and of a light brown colour. *Saxony.*

LIII. *b* 3. Considerably more ponderous, and of an ochry yellow colour. *Joannegeorgensbadt.*

LIV. *c* 1. Of a membranaceous texture and white colour. (*Caro Montana. Cuire fossile.*) *Kongberg.*

LV. *c* 2. The same, of a dull white colour, enveloping crystals of calcareous spar. *Sweden.*

SPECIES XII. *ACTYNOLITE*.*Strahlstein, Wern.*

This is met with either in long prismatic crystals with smooth or striated surfaces, or in aggregated masses of a lamellated, foliated, striated, or fibrous texture. Its colour is generally green, brown, yellow, or white, with more or less transparency and lustre. Its crystals are remarkably brittle. In the amorphous state it is harsh to the feel, and sometimes of great hardness. Specific gravity from 2.80 to 3.45. It does not effervesce with acids. When heated to redness it only changes colour, but in the higher degrees of heat it melts into a compact glass. By most authors till lately, the principal varieties of this species, particularly the crystallised, have been described as schorls.

## VARIETY

## VARIETY I. CRYSTALLISED.

LVI. *a* 1. In compressed hexhedral prisms with smooth surfaces, transparent, and of a leek-green colour (*Glassy Actynolite*), imbedded in white flaty talc.

*Zillertal, Tyrol.*

Analysis.—Carbonate of Magnesia 20, Silica 64, Carbonate of Lime 9.3, Alumina 2.7, Oxyd of Iron 4. *Berg.*

LVII. *a* 2. The same, in smaller aggregated crystals, diverging from different centers, without matrix. *Same place.*

LVIII. *b* 1. In long striated prismatic crystals of a yellowish green colour (*Schor-laceous Actynolite*) penetrating the substance of transparent crystallised quartz. *Spain.*

LIX. *b* 2. In slender prisms of an olive green colour, truncated at their extremities, and united into diverging fasciculi, on ash coloured indurated clay. *Dauphiné.*

LX. *b* 3. The same, in longer crystals, with white silky amianthus. *Same place.*

LXI. *b* 4. In flatted prismatic crystals of a somewhat lamellar texture and dark green colour, intermixed with ash coloured felspar. *Scotland.*

LXII. *b* 5. The same, transparent, of a grass green colour, and electric, cut and polished (*Peridot*). *Brazil.*

LXIII. *b* 6. In striated prisms of a greenish blue colour and transparent, terminated by obtuse trihedral pyramids, the borders of which are deeply truncated.

*R. de L. Pl. 4. Fig. 93.*

*Ceylon.*

LXIV. *b* 7. In opaque octohedral prisms of a yellowish green colour, intermixed with white calcareous spar. *Sala, Sweden.*

LXV. *b* 8. The same, of a dull green colour. *Same place.*

LXVI. *b* 9. The same, of a pale greenish white colour. *Scotland.*

## VARIETY II. AMORPHOUS.

*a.* Lamellated (*Lamellar Actynolite*).

*b.* Foliated,

Analysis.—Magnesia 22, Silica 43, Iron 34. *Weiglib.*

LXVII.

LXVII. *c* 1. Composed of longitudinal striæ of a greenish white colour. *Sweden.*

LXVIII. *c* 2. Composed of diverging striæ of a whitish green colour.  
*Saltzburg, Tyrol.*

LXIX. *c* 3. The same, of a pale green colour. *Sweden.*

LXX. *d* 1. Composed of long undulating fibres, of a dull green colour, intermixed with ochry yellow. *Isle of Skye.*

LXXI. *d* 2. Of a pale greenish colour, and silky lustre. *Sweden.*

LXXII. *d* 3. Composed of long rigid fibres, of a greenish white colour, and silky lustre. *Corfica.*

LXXIII. *d* 4. Composed of longer fibres, of a leek-green colour. *Sweden.*

LXXIV. *d* 5. The same, of a paler colour and silky lustre, with yellow copper ore. *Sweden.*

LXXV. *d* 6. The same, of a still lighter colour, and more silky appearance, also with yellow copper ore. *Sweden.*

### SPECIES XIII. *JADE.*

*Lapis Nephriticus. Nephrit, Nierestein, Germ.*

This stone is found either in rounded detached masses, or as a constituent part of certain kinds of granite. Its colour generally is yellowish green, inclining sometimes to blue or white, with more or less semitransparency. Its surface is usually smooth and unctuous. In its fracture it has also somewhat of a waxy appearance. It is of great hardness, and very tough. Its specific gravity from 2.95 to 3.38. By calcination it becomes white and opaque; but when free from foreign admixture, it is infusible in the strongest heat. By *Mr. Hæpfner's* analysis it appears to contain Carbonate of Magnesia 38, Silica 47, Carbonate of Lime 2, Alumina 4, Oxide of Iron 9.

The hatchets and other tools, used by the inhabitants of the South-sea Islands before the introduction of iron by the Europeans, were all made of this stone. By *Pott, Baumer*, and other authors, it has been confounded with serpentine.

### VARIETY I. *AMORPHOUS.*

LXXVI. *a* 1. In polished slabs, of a compact texture, semitransparent, and of a wheyish colour. *China.*

LXXVII.

LXXVII. *a* 2. Two specimens, semitransparent; one of a light greenish colour with lighter coloured opake spots; the other of a light greenish white colour, artificially polished.

*Same place.*

LXXVIII. *a* 3. Semitransparent, and of a greenish white colour.

*Cbina.*

LXXIX. *a* 4. In rounded nodules more or less transparent, and of various shades of yellowish green.

*Scotland.*

LXXX. *a* 5. In a thin polished slab, semitransparent, and of a pale leek-green colour.

*South-Sea Islands.*

LXXXI. *a* 6. Polished pieces of the same, of a deeper green colour.

*Same place.*

#### SPECIES XIV. *BAIKALITE.*

This stone, which has hitherto been found only on the borders of the lake *Baikal*, in *Siberia*, is of an olive green colour. It occurs in slightly transparent, shining, and somewhat unctuous tetrahedral, hexhedral, or octohedral prisms, terminated by oblique pyramids. Each crystal is from two to ten inches long, and from half to four inches thick. The surface is generally smooth, sometimes longitudinally striated. Fracture splintery. Nearly of sufficient hardness to give fire with steel. Specific gravity 2.20. It does not effervesce with acids, sometimes reddens in the fire, and at last melts into a dark green glass. By the analysis of *Lowitz* it contains Magnesia 30, Silica 44, Lime 20, Oxide of Iron 6.

*Vide Kirwan's Mineral. Vol. I. P. 509.*

#### SPECIES XV. *BORACITE.*

*Chaux Boracique, Fr.*

This combination of boracic acid with lime and magnesia is found in solitary cubic crystals, entire or truncated, imbedded in reddish gypsum. They are generally of a white or greyish white colour and semitransparent; of a shining surface, and laminated texture; they are so hard as to strike fire with steel; specific gravity from 2.07 to 2.56. They neither effervesce nor dissolve in acids, unless by the assistance of heat; when moderately heated they become electric like the tourmaline; by calcination they lose their transparency, and under an intense heat melt. According to *Mr. Westrumb's* analysis, they contain Boracic Acid 68, Magnesia 13, Lime 11, Silica 1, Alumina 1, Iron 1. The Alumina, Silica, and Iron, he considers as accidental.

#### VARIETY

## VARIETY I. CRYSTALLISED.

LXXXII. *a* 1. In solitary dodecahedral crystals, imbedded in reddish grey gypsum.  
*Luneburg, Hanover.*

LXXXIII. *a* 2. In detached semitransparent crystals, of a greenish white colour,  
 having the cube variously truncated. *Same place.*

## GENUS V. ARGILL.

*Alumine, Fr. Thonerde, Germ.*

This earth is never found native in a state of perfect purity. To obtain it wholly uncombined, it is necessary to precipitate it from a solution of sulphate of alumine by pure ammonia.

The earth thus procured is of a snow white colour, smooth, unctuous, and easily diffusible in water, with which it becomes plastic. In a state of ordinary dryness it is capable of absorbing  $2\frac{1}{2}$  times its weight of this fluid, but contracts and squeezes out the greater part of it when exposed to a freezing temperature. Specific gravity according to *Kirw.* 2.

It combines, though difficultly, with most of the acids, forming, with the sulphuric, alum, with the others very deliquescent salts. When heated in the common fire, it decreases in bulk, and may be hardened to such a degree as to give fire with steel; but can only be fused by the flame of oxygen gas. Microcosmic salt and borax dissolve it readily, the former with considerable effervescence, the latter with scarcely any. The fixed alkalis fuse it with more difficulty, but even in the moist way when pure they have a very perceptible action on it. By exposure to the higher degrees of heat it loses the property of becoming plastic with water.

## SPECIES I. CARBONATE OF ARGILL.

*Lac Lune. Rein Thonerde, Germ.*

Is of a snow white colour, somewhat harder than chalk, of a meagre but soft feel, and on examination by the microscope, appears composed of minute transparent crystals. Specific gravity 1.669. It adheres but slightly to the tongue, and does not readily diffuse itself through water. It effervesces with acids, and is infusible at  $166^{\circ}$  of *Wedgw.* According to the analysis of *Mr. Schrieber*, by whom it was first found near *Halle* in the territory of *Magdebourg*, it consists of Carbonate of Alumine, mixed with a little Carbonate and Sulphate of Lime, and some Oxyde of Iron.

H

VARIETY

## VARIETY I. OF PARTICULAR SHAPES.

I. a 1. Carbonate of Argill, in detached reniform masses, white, friable, and composed of extremely fine particles. *Halle near Magdebourg.*

## SPECIES II. CLAY.

A mixture of alumine and filex in any proportion, so that the mass be ductile on mixture with water and harden in the fire, constitutes what is generally understood by the term clay. There are few clays however that do not contain a small proportion of magnesia and oxyde of iron. They are found of different degrees of induration, and of various colours, derived from metallic oxyds or vegetable or bituminous matter. The proportion too of alumine and filex varies considerably, though the filex is usually predominant, and on the different proportion of these two ingredients is founded the difference between procelain and potters clay. Such as contain only Alumine and Silex are infusible in the common furnace. Clay is found usually in extensive beds or strata.

## VARIETY I. AMORPHOUS.

II. a 1. Clay of a dull white colour, soft, meagre, and ponderous; used in the manufacture of porcelain. *Saxony.*

III. a 2. The same intermixed with scales of white silvery mica. *Cornwall.*

This clay, according to the analysis of *Mr. Wedgwood*, contains Alumine 60, Silex 20 per ct.

IV. a 3. White porcelain clay of a meagre feel. *St. Yries, Lemonge.*

The specific gravity of this is, according to *Briffon*, 2,348. By *Mr. Hassenfratz's* analysis it contains when dried, Silex 62, Alumine 19, Magnesia 12, and a little Sulphate of Baryte.

V. a 4. The same, in a pulverulent form. *Saxe-Gotba.*

VI. b 1. White porcelain clay, light, soft and unctuous. *Saxony.*

VII. b 2. The same, from *Halberstadt.*

VIII. b 3. Somewhat less unctuous, from the neighbourhood of *Ratisbon.*

IX. b 4. Porcelain clay, of a dull white colour with a mixture of red, and of a remarkably fine texture. *Germany.*

X b 5.



X. *b* 5. The same, of a dull white colour slightly inclining to yellow, ponderous, compact, and somewhat unctuous. *Meiffon.*

XI. *b* 6. The same, of a light olive colour, unctuous and compact. *Bologne.*

XII. *b* 7. The same, of a pale reddish white colour. *Cornwall.*

XIII. *b* 8. White porcelain clay, slightly inclining to blue (*pipe clay*).  
*Pool, Dorsetshire.*

From the inferior part of the bed from which this clay is taken, and which is of a much whiter colour, the potteries in Staffordshire and other parts of the kingdom are principally supplied.

XIV. *b* 9. Porcelain clay, of a very pale flesh colour. *Italy.*

XV. *b* 10. Porcelain clay, white and friable. *Cornwall.*

This and Number III. appear to be the produce of the decomposition of granite, and have been successfully employed in the manufactories of *Mr. Wedgwood.*

XVI. *c* 1. Indurated clay, very unctuous, of a pale bluish red colour. *Cornwall.*

XVII. *c* 2. The same, of a dark brown colour. *Silesia.*

XVIII. *c* 3. Of an ochre yellow colour. *Shotover-Hill, Oxfordshire.*

XIX. *c* 4. Of a meagre feel, and dull white colour, and so hard as to strike fire with steel. *Hornberg, Germany.*

XX. *d* 1. Clay of a stony texture, and bluish grey colour, with vegetable impressions. (*Shale.*) *Shropshire.*

XXI. *d* 2. The same, more compact and unctuous. *Same place.*

### SPECIES III. *LITHOMARGA.*

*Steinmark, Germ.*

Of this *Mr. Kirwan* makes two varieties, the friable and the indurated. The friable of a white, or yellowish or reddish white colour, opaque and with little or no lustre, composed of very fine scaly particles, adhering strongly to the tongue, of a smooth feel, and capable of being polished by the nail. In water it immediately breaks and falls to powder.

The indurated of a grey, red, brown, yellow, or blue, of various shades and mixtures. Its surface smooth and polished, of a fine grain, and generally of a soapy feel; some

specimens so hard as scarcely to yield to the knife. Its fracture earthy, often conchoidal, specific gravity 2.815. It crumbles more or less readily in water, and fuses in a strong heat into a porous mass. It is found in the clefts of rocks, and forms a constituent part of some aggregated stones—The indurated lithomarga of *Osmund*, according to the analysis of *Bergman*, consists of Alumine 11, Silica 60, Carbonate of Lime 5.7, Carbonate of Magnesia 0.5, Oxyd of Iron 4.7, Air and Water 18.

#### VARIETY I. AMORPHOUS.

##### a. Friable.

XXII. *b* 1. Indurated lithomarga of a carnation colour, unctuous to the feel and conchoidal in its fracture. *Salzburg.*

XXIII. *b* 2. Of a violet colour, mottled with lilac and white, (*Terra miraculosa*).  
*Planitz near Zwickau, Saxony.*

XXIV. *b* 3. The same cut and polished. *Same place.*

XXV. *b* 4. White indurated lithomarga, mixed with ochre yellow and black spots.  
*Siberia.*

XXVI. *b* 5. Of a yellowish white colour, cut and polished. *Salzburg.*

XXVII. *b* 6. Of a pale lavender blue colour, with flesh coloured and whitish spots slightly ochry on the surface. *County of Antrim, Ireland.*

XXVIII. *b* 7. Of a yellow colour, mottled with blue and red. *Montmartre.*

XXIX. *b* 8. Of a violet colour, meagre feel, and porous texture.

#### SPECIES IV. FULLERS EARTH.

*Terre à Foulans, Fr. Walkerde, Germ.*

This occurs in strata of a greenish yellow, bluish grey, greyish brown, greenish grey, greenish brown colour, &c. When fresh dug it is of moderate hardness, of a compact earthy texture, and unctuous feel. It has an earthy smell when breathed on, but does not adhere to the tongue, except when dry, and then but slightly. It breaks readily into powder in the mouth, and feels somewhat gritty between the teeth; immersed in water it falls readily into a loose powder. In the fire, it acquires a yellowish brown colour and stony hardness. At 90° *Wedgw.* it is converted into a porous slag. When  
pure

pure it does not effervesce with acids. Heated with microcosmic salt, it effervesces a little at first, and is somewhat dissolved, but the remainder is no farther acted on. With borax it is more corroded, and dissolves, though slowly; but with natron it effervesces powerfully. The finer kinds are found near *Reigate* in *Surrey*, *Maidstone* in *Kent*, and *Woburn* in *Bedfordshire*.

According to *Bergman's* analysis of what he calls the *Hampshire* fullers earth, which appears to be the same with that found in *Surrey*, it contains Silica 51.8, Carbonate of Lime 3.3, Carbonate of Magnesia 0.7, Alumina 25.0, Oxide of Iron 3.7, Water and other volatile matter 15.5.

#### VARIETY I. AMORPHOUS.

- XXX. a 1. Fullers earth, of a greenish yellow colour. *Reigate, Surrey.*  
 XXXI. a 2. The same, of a yellowish grey colour. *Same place.*  
 XXXII. a 3. Of an ochre yellow colour inclining to green. *Same place.*  
 XXXIII. a 4. The same, of a paler colour. *Hampshire.*

#### SPECIES V. BOLE.

This substance, which appears to differ from friable lithomarga only in the firmness of its texture, is described as being moderately coherent, soft, composed of very fine particles, smooth to the touch, breaking easily between the fingers, readily diffusible, and freely subsiding in water. The *Terra-Lemnia*, ranked amongst the boles by *Mr. Kirwan* and others, contains, according to the analysis of *Bergman*, Alumina 19, Silica 47, Carbonate of Lime 5.4, Carbonate of Magnesia 6, Oxide of Iron 5.4, Water and Air 17.

#### VARIETY I. AMORPHOUS.

- XXXIV. a 1. Bole of a tile-red colour, earthy texture, and friable. (*Armenian bole of the shops.*) *Armenia?*  
 XXXV. a 2. The same, of a lighter colour. *Same place.*  
 XXXVI. a 3. Of an orange-red colour, and somewhat unctuous to the feel. *Blois, France.*  
 XXXVII. a 4. The same, interspersed with veins of yellow, and of a coarser texture. *Stiria.*  
 XXXVIII.

XXXVIII. *a 5.* The same, of a pale pink colour, intermixed with green mica.

*Saxony.*

XXXIX. *a 6.* In flattened nodules of a bluish colour.

XL. *a 7.* Different specimens of bole artificially rounded, and stamped with a variety of impressions. (*Ferre Sigillata.*)

*Hungary, Armenia, Lemnia, &c.*

## SPECIES VI. TRIPOLI.

*Tripel, Germ.*

Its colour is yellow, red, or grey, of various shades; its texture fine grained, sometimes loosely earthy, but generally indurated; of an harsh, dry, meagre feel; fracture earthy, flatly conchoidal or flaty; specific gravity 1.850. It imbibes a considerable proportion of water, upon immersion, and then, in a longer or shorter time, according to its hardness, falls to powder. It is not soluble in acids. It hardens in the fire, and at length vitrifies. The yellow and grey kinds, when exposed to heat, become red. According to the analysis of *M. Haasse*, it contains Silica 90, Alumina 7, Oxide of Iron 3; though the Alumina and Iron are in general in greater proportions. It takes its name from *Tripoli* in *Africa*, where it was originally found.

## VARIETY I. AMORPHOUS.

XLI. *a 1.* Tripoli of a light brown colour.

*Tripoli, Africa.*

XLII. *a 2.* The same, of a pale yellow colour.

*Bohemia.*

## SPECIES VII. LEPIDOLITE.

The colour of this in the mass, the form in which it generally occurs, is violet blue or purple, but in thin laminæ silvery white with a pearly lustre; its texture foliated with fine grained distinct concretions; specific gravity 2.816; easily scratched by the knife; brittle. Before the blow-pipe it melts with moderate spumescence, into a white semi-transparent enamel. With mineral alkali it slightly effervesces, affording a red and blue spotted mass. Borax readily dissolves it, microcosmic salt with more difficulty. When exposed to a red heat, it assumes a yellow colour, losing about 1 per cwt. of its weight. In a melting heat it loses 25 per cwt. and runs into an opaque reddish grey enamel. By *Klaproth's* analysis it consists of Silica 54.5, Alumina 38.25, Oxide of Iron and Manganese 0.075; Water and Air 2.5. Found principally at *Rozena* in *Moravia*.

## VARIETY

## VARIETY I. CRYSTALLISED.

XLIII. *a* 1. Lepidolite in a very compressed tetrahedral rhomboidal prism of a white colour; semitransparent and of a glassy lustre (*Glassy Lepidolite*), with a granular calcareous substance adhering, called by some *Calcareous Lepidolite*. *Tyrol.*

XLIV. *a* 2. The same, in small crystals imbedded in white flinty talk. *Spain.*

XLV. *a* 3. In flattened irregular crystals, of a dull white colour and confusedly aggregated? *Sweden.*

XLVI. *a* 4. The same, in less distinct crystals, of a more pearly lustre, on grey emery? *Turkey.*

## VARIETY II. AMORPHOUS.

XLVII. *a* 1. Lepidolite in the mass, of a pale purple colour, intermixed with silvery scales. *Mabrin, Bohemia.*

## SPECIES VIII. SAPPARE.

*Cyanite, Wern.*

The colour of this stone is bluish, greenish or yellowish grey, with deep blue streaks and spots of silvery white, with pearly lustre; in thin pieces semitransparent. It sometimes occurs in compressed tetrahedral prisms, but its more frequent form is in irregularly lamellated masses. It is brittle, gives fire with steel, and feels somewhat greasy; specific gravity 3.092 to 3.517. When exposed to a heat of 157° *Wedw.* it becomes almost perfectly white, but shews no sign of fusion. It is difficultly fused by borax, scarcely by microcosmic salt, and not at all by fixed alkalis. It contains, according to the analysis of *Saussure Jun.* Alumine 0.6692, Magnesia 0.1325, Silica 0.1281, Lime 0.0171, Oxide of Iron 0.0548. It is found for the most part in mountains of granite.

## VARIETY I. CRYSTALLISED.

XLVIII. *a* 1. Sappare in compressed tetrahedral prisms, of a sky blue colour, in white silvery micaceous quartz. *Zillertal, Tyrol.*

XLIX. *a* 2. In semitransparent prismatic columns of the same colour, with pale violet coloured felspar and quartz. *Same place.*

## SPECIES IX. MICA.

*Glimmer, Gerra.*

Is for the most part either of a yellowish or greenish grey, silvery white, brownish, reddish, yellowish, greenish or blackish colour. It has commonly a metallic lustre, and a considerable degree of transparency, flexibility, and elasticity; feels smooth, but not greasy; is readily scratched by the knife, and varies in its specific gravity from 2.654 to 2.934. It is fusible with more or less difficulty according to its degree of colour. It is sometimes found crystallised in thin hexagonal plates, or in hexedral prisms composed of an accumulation of these; but occurs most commonly in detached fragments or undulatingly foliated masses, entering as a constituent part into granite, gneiss and other primitive stones. According to *Kirwan* the common mica contains Silica 38, Alumina 28, Magnesia 20, Oxide of Iron 20.

## VARIETY I. CRYSTALLISED.

L. a 1. Mica in hexagonal tabular crystals of a green colour, closely united, and set edgewise; with crystals of brown spathose tin ore, imbedded on the surface.

*Altenberg.*

LI. a 2. In aggregated hexagonal crystals of a bright brownish white colour, with transparent quartz.

*Tyrol.*

LII. a 3. Of a darker colour with white quartz, and small crystals of cubic fluor of a dark purple colour, truncated at their solid angles.

*Same place.*

LIII. a 4. In small irregularly aggregated crystals of a shining green colour, intermixed with oxide of iron.

*Ehrenfriedersdorf.*

LIV. a 5. Forming a large hexagonal plate of a smoky grey colour. *South America.*

LV. a 6. In small greenish brown crystals intermixed with shattery quartz.

*Tyrol.*

LVI. b 1. In small indeterminate aggregated laminæ of a dark reddish brown colour, interspersed with a small proportion of flesh-coloured decomposed felspar.

*Auvergne.*

LVII. b 2. In irregular aggregated laminæ of a dark brown colour, intermixed with white quartz.

*Tyrol.*

LVII. b 3.

LVIII. *b* 3. In small rhomboidal plates of a silvery white colour, interspersed through reddish felspar. *South America.*

## VARIETY II. AMORPHOUS.

LIX. *a* 1. Mica in broad flat laminæ, of a bright silvery white colour, imbedded in white quartz. *Bohemia.*

LX. *a* 2. In large aggregated undulating laminæ, of a tarnished silvery white colour, with blende and galena. *Bannat.*

LXI. *a* 3. The same, of a darker colour, imbedded in pale red felspar, intermixed with white quartz. *Scotland.*

LXII. *a* 4. In small silvery scales with a greenish tinge, intermixed with white quartz. (*Star Stone.*) *Sweden.*

LXIII. *a* 5. In broad laminæ of a dark brown colour, aggregated into an irregular mass, and interspersed with greenish felspar. *Cornwall.*

LXIV. *a* 6. In irregular plates, composed of large shining laminæ of a brownish black colour. *Russia.*

LXV. *a* 7. Forming a detached portion, composed of broad laminæ of a greenish brown colour. *Bohemia.*

LXVI. *a* 8. The same, composed of large shining laminæ, closely compacted, and of a silvery grey colour. *Scotland.*

LXVII. *a* 9. Forming a vein, composed of closely compacted shining laminæ of a dark brown colour, in red hematite. *Altenberg.*

LXVIII. *a* 10. In small laminæ of a golden colour, imbedded in brown sand stone. *Bohemia.*

LXIX. *a* 11. In small closely compacted scales, of a golden colour inclining to brown. *France.*

LXX. *a* 12. Forming parallel striæ, of a silvery white colour, in white sand stone. *Same place.*

LXXI. *a* 13. In smooth and shining laminæ, of a smoky grey colour. *Muscovy.*

LXXII. *a* 14. In minute scales slightly cohering, of a light silver colour with an admixture of red. *France.*

LXXIII. *a* 15. In loose scales (*Chaffy Mica*) of the following colours, white, yellowish white, reddish white, brown, reddish brown, and light green.

The last from *Scotland*, the others from *France*.

#### SPECIES X. MICARELLE.

(So called by *Kirwan*.)

Found in granite, of a brownish black colour, and metallic lustre; opaque, of a foliated texture and moderate hardness; specific gravity 2.980; melts at 153, *Wedgw.* into a black compact glass. According to the analysis of *Klaproth*, consists of Alumine 63, Silica 29, Oxyde of Iron 7; but by that of *Bergman* it agrees precisely with the silvery mica of *Altenberg*.

#### VARIETY I. AMORPHOUS.

*a.* Interspersed.

#### SPECIES XI. HORNBLLENDE.

Under this species are comprehended the *Crystallised* or *Basaltic Hornblende*, the *common Hornblende*, and the *Schistose Hornblende*.

The colour of the *basaltic* is black, greenish black, or dark or yellowish green; in very thin pieces semitransparent; texture laminated; gives fire readily with steel; specific gravity 3.333. It crystallises in hexhedral prisms with trihedral pyramids having rhombic faces, or in tetrahedral prisms, with dihedral summits, or in compressed hexhedral prisms with oblique dihedral summits, or in rhomboidal decahedrons. At 119 *Wedgw.* it melts into a greyish or greenish black glass. According to *Bergman's* analysis, it contains Silica 58, Alumine 27, Lime 4, Magnesia 1, Oxyde of Iron 9. Found in *Lava*, *Basalt*, *Wacken*, and *Granite*.

The *common Hornblende* is of a black, greyish black or dark green colour; opaque, tough, and of a foliated fracture; may be scratched by the knife, and gives a greenish streak; specific gravity from 2.660 to 3.880; melts *per se* at 89 *Wedgw.* into a black glass with grey spots. According to the analysis of *Kirwan*, it contains Silica 37, Alumine 22, Carbonate of Magnesia 16, Carbonate of Lime 2, and Oxyde of Iron 23.

The *Schistose Hornblende* is of a greyish black, greyish green, or greyish blue colour; frequently



frequently of a silky lustre; opaque; texture striated; gives a greenish grey streak; and breaks with difficulty; specific gravity from 2.909 to 3.155. When heated it acquires a reddish tinge, and fuses at 80, *Wedgw.* into a black compact glass. Found in large masses.

#### VARIETY I. CRYSTALLISED.

*a.* In hexhedral prisms with trihedral pyramids having rhombic faces.

*b.* In tetrahedral prisms with dihedral summits.

LXXIV. *c* 1. Hornblende in small compressed hexhedral prisms, terminated by oblique dihedral summits, of a shining black colour, imbedded in white friable quartz, with greenish yellow mica. *Vesuvius.*

LXXV. *d* 1. In rhomboidal decahedrons, having the acute edges of the bases of the pyramids truncated, imbedded in an ochry indurated clay. *Scotland.*

*R. de L. Pl. 5. Fig. 10.*

LXXVI. *d* 2. The same, in detached crystals. *Bohemia.*

LXXVII. *d* 3. The same, in more splendid crystals, of a darker colour, with crystallised mica and quartz. *Vesuvius.*

LXXVIII. *d* 4. The same, imbedded in a brown argillaceous cement. *Same place.*

LXXIX. *e* 1. Hornblende, forming a confusedly crystallised mass. *Sweden.*

LXXX. *e* 2. In irregular crystals with olivin, imbedded in dark grey trap. *Ireland.*

LXXXI. *e* 3. Of a dull colour, and compact texture. *Johnsgeorgenstadt.*

#### VARIETY II. AMORPHOUS.

LXXXII. *a* 1. Hornblende, composed of small compacted laminæ of a dark greenish grey colour. *Sweden.*

LXXXIII. *a* 2. In an irregular mass, composed of broad shining laminæ, intermixed with ochre of iron. *Salzburg.*

LXXXIV. *a* 3. Composed of very broad laminæ of a dark blackish brown colour. *Ehrenfridersdorf.*

LXXXV. *a* 4. Of a dark blackish brown colour, intermixed with green felspar. *Norway.*

LXXXVI.

LXXXVI. *a* 5. In small black shining scales, intimately intermixed and stratified with white quartz. *Norway.*

*b*. Striated.

LXXXVII. *c* 1. Hornblende of a dark grey colour and slaty texture, composed of folia aggregated into broom-like fasciculi (*Schistose Hornblende*). *Scotland.*

LXXXVIII. *c* 2. Of a lighter brown colour and duller aspect. *Altenberg.*

## SPECIES XII. RESPLENDENT HORNBLLENDE.

Of this there are two varieties, the *Labrador Hornblende* and *Schiller Spar*. The colour of the former is greyish black, reflecting a strong iron grey, mixed with dark copper red. It is opaque; of a curved foliated fracture, gives fire plentifully with steel; specific gravity from 3.35, to 3.434.

The colour of the latter is yellowish, greenish, or golden yellow, reflecting a white, grey, or yellow; of a metallic lustre, and in thin pieces slightly semitransparent; its fracture foliated; its hardness usually inferior to that of the former variety; specific gravity 2.882. At 141, *Wedgw.* forms a porcelain mass. According to the analysis of *Gmelin*, contains Silica 4.37, Alumina 1.79, Magnesia 1.12. Oxyde of Iron 2.37. Found usually in *Serpentine*.

## VARIETY I. AMORPHOUS.

LXXXIX. *a, aa* 1. Resplendent hornblende of a greyish copper red colour, and foliated texture. *Labrador.*

XC. *a, bb* 1. Of a light greenish grey colour, in dark green serpentine (*Schiller spar*). *Basta, Hartz.*

XCI. *a, bb* 2. The same, cut and polished. *Same place.*

## SPECIES XIII. BASALT.

Its colour is greyish black, bluish or brownish black, on exposure to air acquiring a reddish brown, from the oxydation of its iron. It is opaque; of a fine splintery fracture; gives fire difficultly with steel; specific gravity from 2.864 to 3.000. It occurs in columns of different sizes, the number of sides varying from three to nine; sometimes articulated, sometimes with simple transverse sections or joints, and frequently entire.

entire. At  $100^{\circ}$  *Wedgw.* it melts into a black compact glass. According to the analysis of *Bergman*, it contains Silice 50, Alumine 15, Carbonate of Lime 8, Oxyde of Iron 25, Magnesia 2. Its chief varieties are *Basalt* properly so called, *Trap*, *Wacken*, *Mullen*, *Kragg*, &c. differing from each other in form, texture, specific gravity, and fusibility. Basalt is found no where in more numerous and perfect columns than at the Giant's Causeway on the north coast of *Ireland*, and the corresponding coast of *Scotland*.

#### VARIETY I. OF PARTICULAR SHAPES.

XCII. *a* 1. Portion of a trihedral basaltic column internally of a bluish black colour, externally of a brownish ochry appearance. *Coast of Antrim, Ireland.*

XCIII. *a* 2. The same, with irregular faces. *Vicentine Territories.*

XCIV. *a* 3. The same, cut and polished on one side. *Monte Bolea, Veronesi.*

XCV. *a* 4. In a rounded fragment of the same colour and texture, cut and polished. *Near Cassel.*

*b*. Tabular.

*c*. Lenticular.

#### VARIETY II. AMORPHOUS.

XCVI. *a* 1. Basalt of a dark liver brown colour mixed with green, with a vein of greenish grey lime-stone. *Fablan, Sweden.*

XCVII. *a* 2. Of a bluish black colour and fine grain. *Coast of Antrim, Ireland.*

XCVIII. *a* 3. Of a blackish grey colour, and coarser grain. *Arthur's Seat near Edinburgh.*

XCIX. *b* 1. Of a bluish black colour, and coarse grain; (*Rowley Rag.*) *Staffordsh.*

Found by Dr. *Wiserling* to consist of Silice  $47\frac{1}{2}$ , Alumine  $32\frac{1}{2}$ , Oxyde of Iron 20. *Phil. Transf.* 1782.

C. *b* 2. Of a reddish brown colour, extremely hard and compact. *Near Edinburgh.*

CI. *b* 3. Of a coarser texture and greenish grey colour. *Isle of Bute.*

CII. *b* 4. Of a blackish grey colour, coarse grain, and extremely hard. *Derbyshire.*

CIII. *b* 5. Of a bluish grey colour, and coarse earthy texture, inclosing irregular nodules of white calcareous spar. (*Toadstone.*) *Same place.*

CIV. *b* 6.

CIV. *b* 6. The same, of a chocolate brown colour, cut and polished. *Same place.*

CV. *b* 7. Of a reddish grey colour (*Kragg*) inclosing rounded masses of zeolite.  
*Antrim.*

CVI. *b* 8. The same, of a redder colour. *Same place.*

#### SPECIES XIV. CALP.

*Quarry Stone of Dublin.*

This stone is described by *Mr. Kirwan* as follows: its colour dark greyish blue, intersected with veins of white calcareous spar; opaque; of a fine splintery fracture, splitting easily into large flags; yields with difficulty to the knife; specific gravity from 2.646 to 2.70. It gives a white streak, effervesces with mineral acids, and, when breathed on, has an earthy smell. At 130 *Wedgw.* melts into a black compact glass, and contains 50 per cwt. of Carbonate of Lime, the remainder Alumine, Silex, and Iron.

#### VARIETY I. AMORPHOUS.

CVII. *a* 1. Calp of a bluish black colour, having its surface covered with minute brilliant crystals of cubic pyrites.  
*County of Dublin, Ireland.*

#### SPECIES XV. ARGILLACEOUS SCHISTUS.

*Slate, Ardoise, Fr. Thon Schiefer, Germ.*

Its usual colours are bluish, greenish, greyish or reddish purple, sometimes in stripes or spots. It has frequently a small degree of lustre, arising from interspersed glimmering particles, with a very slight semitransparency. Its texture is slaty, composed of laminæ of various degrees of thickness, straight, curved or undulating. It generally yields easily to the knife, and is never so hard as to give fire with steel. Its specific gravity varies from 2.67 to 2.88. Most varieties imbibe water, but in very different proportions. The chief are *Argillite, Killas, Grapholite*; all which are found in considerable strata.

#### VARIETY I. AMORPHOUS.

CVIII. *a, b, c.* Argillaceous schistus in slabs of different colours.

CIX. *d* 1. Of a bluish black colour and soft texture.

*Saxony.*

CX. *d* 2.

CX. *d* 2. Of a black colour and softer texture (*Grappolite*). *Saxony.*

The hardness of this variety scarcely exceeds that of chalk; specific gravity 2.70; when powdered it effervesces with acids.

CXI. *d* 3. Of a greenish grey colour, micaceous, and inclosing cubic pyrites. *Scotland.*

CXII. *d* 4. In a polished slab of a greyish blue colour. *Westmoreland.*

CXIII. *d* 5. Of a bluish black colour, impregnated with alum (*Aluminous Schistus*).  
*Redechambach.*

CXIV. *d* 6. The same, of a flesh red colour. *Whitby.*

#### SPECIES XVI. NOVACULITE.

*Turkey Hone. Pierre à rafoir, Fr. Wetzstein, Germ.*

Its colour is greenish grey, or pale greyish yellow, of a slight degree of lustre and semitransparency; texture in large masses slaty; occasionally hard enough to afford a few sparks with steel. It has generally a slightly unctuous feel, and sometimes effervesces with acids. Specific gravity from 2.609 to 2.955. At 120 *Wedgw.* it either hardens or melts into a porous enamel. Found in large masses.

#### VARIETY I. AMORPHOUS.

CXV. *a* 1. Novaculite of a pale greyish yellow colour and fine grain. *Turkey.*

#### SPECIES XVII. SULPHATE OF ARGILL.

*Native Alum. Sulphate d'Alumine, Fr.*

Is found either crystallised, or in delicately white or yellowish white capillary filaments of a silky lustre, or forming incrustations on lava, or in soft amorphous masses with a somewhat greasy feel, or dispersed through marshy soils or sands, or impregnating argillaceous schistus or fossil wood, or in solution. It is characterised, when pure, by its astringent taste, ready solubility in water, and the regular octohedral form of its crystals. Its contains Alumine 18, Sulphuric Acid 19, Water 63.

#### VARIETY I. CRYSTALLISED.

*a.* In regular octohedrons.

CXVI. *b* 1:

CXVI. *b* 1. In capillary filaments of a white colour and silky lustre, on grey aluminous schist. *Stablberg.*

CXVII. *b* 2. In long detached silky filaments. (*Haarfalz, Germ.*) *Sicily.*

## VARIETY II. AMORPHOUS.

*Mountain Butter.*

## VARIETY III. IN SOLUTION.

## GENUS VI. SILEX.

*Kiefelerde, Germ.*

This earth is never found naturally in a state of perfect purity. It may however be procured so artificially by fusing powdered quartz with three or four times its weight of either of the fixed alkalies, dissolving the mass in water, and precipitating the earth by adding any of the mineral acids in excess, and afterwards washing the precipitate in distilled water. It may also be procured by digesting quartz, or any other natural form of silicic acid in the nitric acid, by which all heterogeneous substances are taken up and the pure silicic acid left undissolved. In this state it is white, insipid, of a dry harsh feel, and does not become plastic on mixture with water. Though commonly supposed to be insoluble in water, it dissolves, according to *Kirwan*, in 1000 times its quantity of this fluid after precipitation from alkaline solutions. It is not acted on by any of the acids but the fluoric. In the humid way it dissolves in six times its quantity of either of the fixed alkalies, and in the dry way is capable of combining with them in any proportion. It melts with soda with effervescence, with borax slowly and without effervescence, more difficultly with microcosmic salt. It combines also by fusion with most of the metallic oxides, especially those of lead. By itself it is incapable of being fused even in the most intense degree of heat. Many of the compounds of this earth are remarkable for their hardness, transparency, and lustre.

## SPECIES I. DIAMOND.

The diamond is the hardest, most transparent, and brilliant of all mineral substances. It is usually without colour, but is found occasionally, black, yellow, green, blue, brown, or grey; its medium specific gravity 3.521. It occurs either in flattened or rounded grains, or regular octahedrons or dodecahedrons, with their varieties, and

and sometimes in cubes. Its texture generally laminated, but sometimes irregularly fibrous. Like the other gems, it becomes electric on being rubbed, and phosphoric on exposure to the rays of the sun. It differs, however, according to modern experiments from the other precious stones, in being wholly inflammable, and convertible, by union with oxygen, into carbonic acid. It is found in the provinces of *Golconda* and *Visapour* in the *East-Indies*, and in *Brasil*, either in the beds of torrents, or in yellow ferruginous earth, under quartzose or sandstone rocks.

#### VARIETY I. CRYSTALLISED.

- I. *a* 1. In a transparent colourless rectangular octohedron. *Golconda.*
- II. *a* 2. In detached 24 sided crystals of different sizes and colours.  
*R. de L. Pl. 3. Fig. 17, 18. Golconda and Brasil.*
- b.* In dodecahedrons and their varieties.
- c.* Indeterminate.

#### SPECIES II. SAPPHIRE.

The usual colour of this gem is some shade of blue, but it occurs also of a yellow and red colour, and sometimes, though rarely, green. Its figure lengthened hexhedral pyramids applied base to base; its fracture foliated; hardness 17, the diamond being estimated at 20; specific gravity about 3.991. It produces a single refraction like the diamond. It is infusible, and commonly preserves its colour in the most intense furnace heat, but by means of oxygen gas is reducible to an enamel. It is found in various parts of the *East-Indies*, but principally in the island of *Ceylon*, and contains, according to *Bergman*, Alumine 0.58, Silica 0.35, Carbonate of Lime 0.5, and Oxyde of Iron 0.2.

#### VARIETY I. CRYSTALLISED.

- a.* In lengthened hexhedral pyramids joined base to base.  
*R. de L. Pl. 6. Fig. 39.*
- III. *b* 1. In polished specimens of different colours. *Persia and Ceylon.*

#### SPECIES III. TOPAZ OF BRASIL.

The colour of this stone is golden yellow inclining to orange, sometimes however much paler, and even almost white. Its figure the tetrahedral rhomboidal prism terminated

nated by tetrahedral pyramids; its fracture foliated; refraction double; hardness 16; specific gravity 3.536. When heated it becomes red. At 160 *Wedgw.* it is fusible *per se*. It is vitrifiable by borax, and by oxygen gas convertible into an enamel. It is procured from *Brasil*, but has not yet been analysed.

#### VARIETY I. CRYSTALLISED.

IV. *a* 1. In tetrahedral rhomboidal prisms terminated by tetrahedral pyramids, of different shades of colour and size. *Brasil.*

*R. de L. Pl. 5. Fig. 20.*

V. *a* 2. Fragments of large crystals of the same.

*Same place.*

*b.* Indeterminate.

#### SPECIES IV. TOPAZ OF SAXONY.

The colour of this is paler than that of the former, being generally of a wine yellow; its fracture also foliated; its hardness 14; specific gravity 3.564. It occurs in tetrahedral rhomboidal prisms terminated by dihedral summits. When heated it becomes white. At 160 *Wedgw.* it cracks, and by oxygen gas is converted into an enamel. It is found generally with crystallised quartz at *Schneckenstein* in *Saxony*, and, according to the analysis of *Weigleb*, contains Silica 52, Alumina 44, Lime 2, Oxide of Iron .03.

#### VARIETY I. CRYSTALLISED.

VI. *a* 1. In tetrahedral rhomboidal prisms with dihedral summits, and their modifications. *Schneckenstein Voigtland.*

*R. de L. Pl. 3. Fig. 77.*

VII. *a* 2. Portion of an unusually large prism of the same, of a pale yellow colour, having the apex of the pyramid deeply truncated. *Same place.*

VIII. *a* 3. In small crystals, with crystallised quartz, on amorphous grey quartz.

*Same place.*

IX. *b* 1. In rounded detached portions, some polished on the surface. *Same place.*

X. *b* 2. The same, of a lighter colour, cut and polished.

*Same place.*

#### SPECIES



SPECIES V. *BERYL OF SIBERIA.*

Agrees with the preceding in figure, texture, hardness, and, in short, in every respect, except with regard to colour, which is a pale sea green, inclining to blue. It is found in *Siberia*, sometimes in crystals of much greater magnitude than those of the Saxon topaz. It has not yet been analysed.

VARIETY I. *CRYSTALLISED.*

XI. *a* 1. Portion of a tetrahedral rhomboidal prism, having its dihedral summit deeply truncated. *Saltsfen Eybenstock.*

*R. de L. Pl. 5. Fig. 79.*

XII. *b* 1. Portions of the same, cut and polished.

*Same place.*

SPECIES VI. *RUBY.*

Of this stone there are two varieties, the *Spinelle* and the *Balais*, both differing from the oriental ruby of authors, which, from its form and hardness, appears to be only a sapphire of a ruby colour. The *Spinelle* is of a bright red colour; its specific gravity according to *Brissou* 3.7600; its hardness 13. The *Balais* is of a pale rose colour; specific gravity 3.5311; hardness also 13. The texture of both is laminated; their figure the aluminiform octohedron with its modifications. On exposure to the most violent heat, even that of the focus of a lens, the ruby undergoes no alteration; but it is fusible both with microcosmic salt and borax, with the latter without effervescence.

According to *Bergman's* analysis, it contains Alumine 0.40. Silex 0.39, Lime 0.09, Oxyde of Iron 0.10; by *Klaproth's*, Alumine 76, Silex 16, Lime 1, Oxyde of Iron 3. Found in *Persia*, *Ceylon*, and the *Brazils*.

VARIETY I. *CRYSTALLISED.*

XIII. *a* 1. In detached octohedrons of different sizes and their varieties. *Ceylon.*

*R. de L. Pl. 3. Fig. 1.*

XIV. *b* 1. Indeterminate portions of the same.

*Brazil.*

SPECIES VII. *EMERALD.*

*Smaragd, Germ.*

The colour of the emerald is grass green of different shades; its hardness 12; specific gravity 2.775; its fracture conchoidal; refraction double. Its crystals assume the form

of truncated hexhedral prisms, with their modifications. It melts at 150 *Wedgw.* into an opaque colourless mass. The mineral alkali fuses it with difficulty, but it yields more easily to microcosmic salt or borax. It contains, according to the analysis of *Bergman*, Alumine 60, Silica 24, Lime 8, Oxide of Iron, 6. Found chiefly in *Peru*.

#### VARIETY I. CRYSTALLISED.

XV. *a* 1. In truncated hexhedral prisms, with white calcareous spar, imbedded in a brownish calcareous cement. *Peru.*

*R. de L. Pl. 4. Fig. 18.*

XVI. *a* 2. A detached portion of the same. *Same place.*

XVII. *b* 1. Smaller pieces of the same cut and polished. *Same place.*

#### SPECIES VIII. AQUA MARINE.

Under this species are included the *Emerald*, *Aqua Marine* and *Crysolite* of *Siberia*. Its colour is green, greyish green or yellow; its hardness 11; specific gravity from 2.65 to 2.722; fracture foliated; refraction single. Like the emerald, it occurs in truncated hexhedral prisms with their varieties, which differ however from those of that gem in being longitudinally striated. When heated it decrepitates, but does not melt in a heat of 150 *Wedgw.* The mineral alkali acts most strongly upon it, borax very little, and microcosmic salt scarcely at all. According to Mr. *Bindheim's* analysis its constituent parts are Silica 6.4, Alumine 2.4, Lime 0.8, Oxide of Iron 0.1½

Found in the high mountains near *Schlangenberg* in *Siberia*.

#### VARIETY I. CRYSTALLISED.

XVIII. *a* 1. Portion of a truncated hexhedral prism, of a pale greenish blue colour, longitudinally striated. *Siberia.*

\* XVIII. A large crystal of the same. *Same place.*

XIX. *a* 2. Portions of the same cut and polished. *Same place.*

#### SPECIES IX. CRYSOLEITE.

The colour of this is most usually yellowish green, mixed with brown; its hardness according to *M. Quist* 10; its specific gravity from 3.34 to 4.41; fracture conchoidal; refraction double. It occurs in hexhedral prisms, terminated by hexhedral pyramids, differing

differing however from those of quartz in the measurement of their angles. It is infusible at 150 *Wedgw.* but by oxygen gas is converted into an enamel. Borax and microcosmic salt facilitate its fusion, but alkalis have little or no action on it. According to *M. Archaud's* analysis it contains, Silica 0.15, Alumina 0.64, Lime 0.17, Oxide of Iron 0.01.

Found in the *East-Indies*, the *Brazils*, and various parts of *Europe*.

#### VARIETY I. CRYSTALLISED.

XX. *a* 1. In detached compressed hexedral prisms with corresponding pyramids and their modifications. *Red Sea.*

*R. de L. Pl. 6. Fig. 17, 18.*

XXI. *a* 2. The same, in smaller crystals of a light yellow colour. *Brazils.*

XXII. *a* 3. In detached rounded nodules. *Same place.*

XXIII. *a* 4. In portions, cut and polished. *East-Indies.*

#### SPECIES X. HYACINTH.

The colour of this stone is red, with various proportions of brown; it is sometimes also found colourless; its hardness 12 or 13; specific gravity according to *Delametherie* 4.385; but according to *Briffon* 3.6873; its surface smooth; its fracture foliated; refraction double. It is found crystallised in dodecahedrons with unequal rhombic faces, considered by *Delametherie* as derived from the octohedron. Some specimens melt at about 160 *Wedgw.* Alkalis have no effect on it, but it yields to borax and microcosmic salt.

According to the analysis of *Bergman*, it contains Alumina 40, Silica 25, Carbonate of Lime 20, Oxide of Iron 13. According to *Klaproth* Jargon Earth 70, Silica 27, Oxide of Iron, .5, Loss 4.5. Found in *Ceylon* and the brook *Especially* in the South of *France*.

#### VARIETY I. CRYSTALLISED.

XXIV. *a* 1. In dodecahedrons with unequal rhombic faces, of a dull greenish colour.

*R. de L. Pl. 4. Fig. 106.*

*Ebnistock.*

XXV. *a* 2. In lengthened tetrahedral prisms with tetrahedral pyramids, of a brownish red colour. *Ceylon.*

*R. de L. Pl. 4. Fig. 114, 115.*

XXVI. *a* 3. Irregular fragments of the same.

*Same place.*

XXVII.

- XXVII. *a* 4. Portion of a large crystal, cut and polished. *Same place.*
- XXVIII. *a* 5. Portions cut and polished. *Bobemia.*
- XXIX. *b* 1. In small granular portions. *Same place.*
- XXX. *b* 2. In rounded portions of a pale brownish yellow colour. *Ceylon.*

### SPECIES XI. HYACINTH OF VESUVIUS.

The colour of the hyacinth of *Vesuvius* is generally a deep brown, or greenish yellow; its specific gravity 3.409; hardness 9; fracture laminated. It occurs in tetrahedral prisms truncated at their edges, terminated by tetrahedral pyramids truncated at their summits. It fuses into a greenish spongy glass. Its analysis according to *Mr. Stucke* is Silica 26, Magnesia 40, Lime 16. Oxyde of Iron 16. Found imbedded in the erupted matter of volcanos, particularly those of *Vesuvius*, *Silefia*, and *China*.

#### VARIETY I. CRYSTALLISED.

XXXI. *a* 1. In tetrahedral prisms truncated at their angles, terminated by tetrahedral pyramids truncated at their summits, of a reddish brown colour, semitransparent and splendid on the surface, on a volcanic calcareous matrix intermixed with greenish grey mica. *Neighbourhood of Naples.*

*R. de L. Pl. 4. Fig. 125.*

XXXII. *a* 2. The same, in small crystals, of a yellowish brown colour, having the prisms very short, on a similar matrix. *Same place.*

*R. de L. Pl. 4. Fig. 121.*

XXXIII. *a* 3. In large aggregated crystals, of a brownish olive green colour, with deeper truncations, on a white calcareous matrix without mica. *Same place.*

*R. de L. Pl. 4. Fig. 126.*

XXXIV. *a* 4. In splendid crystals, of a yellowish brown colour, in a greenish grey micaceous matrix. *Same place.*

XXXV. *a* 5. In larger and more splendid crystals, with those of the mica remarkably perfect. *Same place.*

XXXVI. *a* 6. The same, in long prismatic crystals, very splendid and striated on the surface, on a micaceous matrix. *Same place.*

XXXVII.

XXXVII. *a* 7. In numerous crystals, nearly of the same colour and configuration with the former, but more confusedly aggregated, and the mica of the matrix distinctly crystallised.

*Same place.*

XXXVIII. *a* 8. The same, with greenish brown crystallised schorl, in yellowish volcanic limestone, intermixed with white quartz.

*Same place.*

XXXIX. *a* 9. In transparent colourless quadrilateral crystals, with greenish mica, on an ash coloured volcanic limestone.

*Same place.*

XL. *a* 10. The same, in more numerous and perfect crystals.

*Same place.*

*R. de L. Pl. 4. Fig. 114.*

XLI. *a* 11. In large crystals of a dark brown colour, the mica of the matrix of a green colour and splendid.

*Same place.*

XLII. *a* 12. In flatted polyhedral crystals, of a yellowish brown colour, with greenish mica, on white calcareous spar.

*Same place.*

XLIII. *a* 13. In a solitary quadrilateral crystal, of a reddish brown colour, truncated at all its longitudinal borders, and without pyramid, implanted in a whitish granular calcareous matrix, intermixed with grey mica.

*Same place.*

XLIV. *a* 14. The same, in larger prisms with their pyramids deeply truncated, on a similar matrix.

*Same place.*

XLV. *a* 15. In larger prisms of the same colour, with brown crystallised mica, in greyish limestone.

*Same place.*

XLVI. *a* 16. In small transparent crystals, of a topaz-yellow colour, lining irregular cavities in a brown sparkling volcanic micaceous matrix.

*Same place.*

XLVII. *a* 17. In splendid suboctohedral crystals, of a greenish yellow colour, and truncated obliquely, on a greyish calcareous matrix mixed with quartz and greenish mica.

*Same place.*

## VARIETY II. AMORPHOUS.

XLVIII. *a* 1. In irregular masses, of a dark yellowish brown colour, interspersed through a dull ash-coloured calcareous matrix.

*Same place.*

## SPECIES

## SPECIES XII. OLIVIN.

The colour of this stone is brownish or reddish green inclining to yellow, or greyish green, becoming, when withered, of a brownish yellow; its hardness 9; specific gravity 3.225. It assumes when crystallised the form of hexagonal prisms, but is more commonly found in roundish grains in *Basalt* or *Trap*; sometimes in large masses. It decomposes readily on exposure to the air, and at 160 *Wedgw.* is fusible into a greenish enamel. It may be distinguished from the crysolite by its being acted on by nitric acid. According to the analysis of *Gmelin*, it consists of Alumine 40, Silica 54.1, Oxide of Iron 4; but according to *Klaproth*, it contains Silica 48—52, Magnesia 37, Lime 2, Oxide of Iron 10—12.

## VARIETY I. CRYSTALLISED.

a. In hexagonal prisms.

## VARIETY II. AMORPHOUS.

a aa. In large masses.

XLIX. a bb 1. Of a pale yellowish green colour mixed with olive brown, in an irregular crystalline shattery mass. *Hesse.*

L. a bb 2. In small specks or grains of the same colour, interspersed through dark grey basalt. *North Coast of Ireland.*

## SPECIES XIII. GARNET.

The colour of the garnet is generally of a deep red verging to violet, but frequently also olive green, brown or black, seldom yellow. Its hardness from 9 to 14; specific gravity from 3.63 to 4.18; fracture foliated; refraction double. It occurs in dodecahedral crystals with rhombic faces, and their varieties. It is fusible *per se* at 136 *Wedgw.* into an opaque dark grey fine grained porcelain. Alkalis fuse it with difficulty, borax and microcosmic salt convert it into a green or black glass. The component parts of this stone are Silica, Alumina, Lime and Iron, the proportions varying in different specimens. According to *Archard's* analysis it contains Silica 48, Alumina 30, Lime 11, Oxide of Iron 1; according to *Weigleb*, Silica 364, Lime 308, Oxide of Iron 287.

It is commonly found in *Schistose Mica* or *Gneiss*, more rarely in *Argillites* or *Granite*. The brightest coloured garnet comes from *Bohemia*.

## VARIETY

## VARIETY I. CRYSTALLISED.

- LI. *a* 1. In a detached dodecahedron with rhombic faces, of a brownish red colour.  
*R. de L. Pl. 4. Fig. 106. Siberia.*
- LII. *a* 2. The same, in smaller crystals. *Tyrol.*
- LIII. *a* 3. In numerous small crystals, of the same colour and figure, imbedded in silvery schistose mica. *Italy.*
- LIV. *a* 4. The same, imbedded in a greenish schistose mica. *Hungary.*
- LV. *a* 5. The same, in a green micaceous matrix, less splendid than the former.  
*Norway.*
- LVI. *a* 6. In very aggregated semitransparent dodecahedral crystals, cemented together by white indurated talc. *Salzburg.*
- LVII. *a* 7. In small semitransparent dodecahedral crystals, of a pale reddish brown colour, aggregated into an irregular mass. *Bohemia.*
- LVIII. *a* 8. In detached irregular crystals. *Tyrol.*
- LIX. *a* 9. In aggregated dodecahedral crystals, of a pale green colour.  
*Ehrenfriedersdorf.*
- LX. *a* 10. In a detached dodecahedral crystal, truncated at all its borders, and covered with silvery mica.  
*R. de L. Pl. 4. Fig. 107. Stiria.*
- LXI. *a* 11. The same, in numerous small crystals, imbedded in dark green indurated talc. *Stenbrusk.*
- LXII. *b* 1. In small loose crystals, red and transparent, with 24 trapezoidal faces.  
*R. de L. Pl. 4. Fig. 110. Saxony.*
- LXIII. *b* 2. The same, in small opaque crystals, imbedded in a shining bronze-yellow micaceous matrix. *Italy.*
- LXIV. *b* 3. In small opaque detached polyhedral crystals, of a dull reddish brown colour. *Silesia.*

- LXV. *c* 1. In small transparent rounded crystals of a bright red colour. *Augberg.*
- LXVI. *c* 2. The same. *Bobemia.*
- LXVII. *c* 3. In detached irregularly rounded crystals, opaque and having a coating of gold-coloured mica. *Scotland.*
- LXVIII. *c* 4. The same, imbedded in a matrix similar to the coating of the former. *Same place.*
- LXIX. *c* 5. In irregular crystals, of a reddish brown colour, imbedded in silvery micaceous schistus. *Transylvania.*
- LXX. *c* 6. The same, in loose fragments. *Bobemia.*

#### VARIETY II. AMORPHOUS.

- LXXI. *a* 1. In a compact polished flab, of a yellowish red colour, semitransparent and spotted with mica. *Bobemia.*
- LXXII. *a* 2. In small semitransparent crystals, of a bright red colour, imbedded in a thin plate of dark green serpentine, cut and polished. *Silefia.*
- LXXIII. *a* 3. The same, imbedded in prase. *Sweden.*
- LXXIV. *a* 4. In transparent portions, of a red colour inclining to violet, cut and polished; (*Syrian Garnet.*) *Syria.*
- LXXV. *a* 5. The same, of a deep red colour. *Bobemia.*
- LXXVI. *a* 6. The same, of a brownish red. *Same place.*
- b.* Foliated.
- c.* Slaty.

#### SPECIES XIV. WHITE GARNET.

*Vesuvian, Kirw. Leucite, Wern.*

This occurs in small white, or greyish white, opaque, and generally friable crystals, from the size of a pin's head to that of a small nutmeg, with 24 trapezoidal faces; its hardness from 8 to 9; specific gravity 2.464. It is fusible *per se* by the blow-pipe, difficultly with alkali, borax, or microcosmic salt. It contains, according to the analysis of *Bergman*,  
Silex



Silex 55, Alumine 39, Lime 6; but according to *Klaproth*, Silex 54, Alumine 23, Potash 20 to 23. By some it has been considered as a variety of zeolite. Found in the lava of *Vesuvius* and other volcanos, also in the gold ores of *Peru*, and in some granites of the *Pyrenees*.

#### VARIETY I. CRYSTALLISED.

LXXVII. *a* 1. In friable crystals of a dull white colour, imbedded in a purplish indurated argillaceous cement. *Vesuvius.*

LXXVIII. *a* 2. The same, in larger crystals, in a more ponderous and indurated cement of a greenish colour. *Same place.*

#### SPECIES XV. TOURMALINE.

The colour of this stone is generally dark brown, but often nearly of a hyacinth red, sometimes verging to the olive green or dark green, or even blue. It occurs in transparent prisms, with three, six, or nine sides, terminated by trihedral summits; its fracture laminated; refraction double; hardness from 9 to 11; specific gravity from 3.05 to 3.15. When heated to about 200 *Farenh.* it becomes electric. It is fusible *per se* with intumescence, forming a whitish spongy enamel. Mineral alkali, borax and microcosmic salt fuse it, though with difficulty. By *Bergman's* analysis it yields, Silex 34—40, Alumine 38.5—42, Lime 10—15, Oxyde of Iron 5—9. Found in granite and other rocks in *Ceylon*, *Brazil*, and the *Alps*. Those from *Zillerthal* are imbedded in steatite.

#### VARIETY I. CRYSTALLISED.

*a*. In striated prisms with 3, 6, or 9 sides, and trihedral summits.

LXXIX. *b* 1. In detached portions of striated prisms, of a dark brown colour, semi-transparent and electric. *Tyrol.*

LXXX. *b* 2. The same, smaller and more transparent. *Same place.*

LXXXI. *b* 3. In detached transparent portions of a brown colour and electric. *Ceylon.*

#### SPECIES XVI. SCHORL.

This differs principally from the former in being of a black colour, opaque and less electric when heated. The figure of its crystals is the same. Heated to redness it acquires

quires by cooling a brownish red colour. At  $127^{\circ}$  *Wedgw.* it is converted into a brownish black enamel, and becomes redder on increasing the heat. Found chiefly in quartz and granite.

# VARIETY I. *CRYSTALLISED.*

LXXXII. *a 1.* In portions of large trihedral prisms, striated and opaque, of a black colour, with convex planes, imbedded in a transparent crystal of quartz. *Marienberg.*

LXXXIII. *a 2.* In large striated trihedral prisms, of a black colour, crossing each other in various directions and cemented by white quartz. *Bohemia.*

LXXXIV. *a 3.* In long striated trihedral prisms, black, opaque and shining, truncated at their extremities and imbedded in green talc. *Tyrol.*

LXXXV. *a 4.* In slender trihedral prisms, of a black colour, and truncated at their summits, with yellowish indurated talc, on grey quartz. *Spain.*

LXXXVI. *b 1.* In slender indeterminate prisms, diverging from different centers, and intermixed with brown spathose tin ore. *Cornwall.*

LXXXVII. *b 2.* In detached portions of large striated irregular prisms, of a shining black colour. *Madagascar.*

LXXXVIII. *b 3.* In slender striated rhomboidal needle-like crystals, truncated at their extremities, implanted in various directions on dark grey quartz. *Saxony.*

LXXXIX. *b 4.* Black, shining, of a striated texture, imbedded in white quartz. *Cornwall.*

XC. *b 5.* In smaller striæ, in a similar matrix. *Saxony.*

XCI. *b 6.* Of a dark brown colour, composed of diverging striæ, aggregated into an irregular mass. *Bohemia.*

XCII. *b 7.* The same, in small needle-like diverging prisms intermixed with quartz. *Same place.*

XCIII. *b 8.* In aggregated prisms, of a dark reddish brown colour, intermixed with silvery mica. *Same place.*

XCIV. *b 9.* In flatted diverging prisms, of a dark greenish colour, with a slight degree of semitransparency, imbedded in a greenish micaceous matrix. *Vesuvius.*

XCV.

XCV. *b* 10. In large, opaque, striated prisms, of a brownish red colour and metallic lustre, with white opaque quartz and greenish mica. (*Titanite.*)

*Bonitz, in Lower Hungary.*

XCVI. *c* 1. In smooth trihedral prisms of a black colour, bevelled at their edges, and imbedded in greenish grey talc.

*Salzburg.*

XCVII. *c* 2. In long smooth hexhedral prisms of a black colour, imbedded in compact dark bronze-coloured mica.

*Sweden.*

XCVIII. *c* 3. Portion of a large hexhedral prism truncated at all the edges, of a dark brown colour, imperfectly striated on the surface.

*Same place.*

XCIX. *c* 4. In detached portions of a black colour.

*Tyrol.*

*R. de L. Pl. 4. Fig. 97.*

The four last specimens, being smooth on the surface, ought perhaps, in strictness of arrangement, rather to be considered as Hornblendes, but in no other respect do they appear to differ from Schorls.

C. *c* 5. In detached compressed hexhedral prisms, some single, others united transversely, opaque and of a dark brown colour. (*Cross Stone.*)

*Brittany.*

*R. de L. Pl. 7. Fig. 40, 41.*

CI. *c* 6. The same, in numerous crystals, imbedded in bluish indurated ochry schist.

*Same place.*

## SPECIES XVII. THUMERSTEIN.

*Schorl Violet, Fr.*

Its colour is generally violet, but when coated or impregnated with chlorite, greenish or pearl grey. It occurs in compressed rhomboidal parallelepipeds, of a laminated texture, and striated on the surface. Hardness from 9 to 10; specific gravity 3.295. When heated a little above redness it swells and foams like zeolite, and at last melts into a hard black enamel. It contains, according to *Klaproth*, Silica 52, Alumina 25, Lime 9, Oxide of Iron 9, Magnesia 1.

Found in most primitive mountains, particularly the *Alps*, *Pyrenees*, and *Mount Atlas*.

## VARIETY

VARIETY I. CRYSTALLISED.

CII. *a* 1. In violet coloured semitransparent compressed rhomboidal parallelepipeds, with striated faces, and having one edge on each face slightly truncated. *Dauphiné.*

*R. de L. Pl. 4. Fig. 96.*

CIII. *a* 2. The same, more deeply truncated and rather paler. *Same place.*

CIV. *a* 3. In larger crystals, having a double truncation on one side, with transparent felspar, on greenish hornblende. *Same place.*

CV. *a* 4. The same, incrustated with green chlorite. *Same place.*

CVI. *a* 5. The same, of a paler colour. *Same place.*

*b.* Indeterminate.

VARIETY II. AMORPHOUS.

SPECIES XVIII. SCHORLITE.

*Schorlartiger Beryll, Wern.*

The colour of which is greenish white, sometimes inclining to yellow, with a slight degree of transparency; its fracture somewhat foliated; hardness from 9 to 10; specific gravity 3.530. Infusible at 168 *Wedgw.* and unalterable by heat. According to *Klaproth* it contains, Silica 50, Alumina 50. Found generally in irregular oblong masses or columns, in a mixture of quartz and mica.

VARIETY I. CRYSTALLISED.

CVII *a* 1. In striated columns, of a purplish white colour, imbedded in a mixed mass of crystallised mica and quartz. Found in a tin mine at *Altenberg, Saxony.*

CVIII. *a* 2. A smaller specimen of the same, of a whiter colour. *Same place.*

SPECIES XIX. RUBELLITE.

The colour of this stone is crimson or peach-red. It occurs in semitransparent aggregated hexedral prisms, terminated by trihedral rhomboidal pyramids, with a rough surface,

face, and fibrous texture. Its hardness 10; specific gravity 3.1. It is infusible *per se*, and resists alkalis, borax, and microcosmic salt. When heated to redness it becomes snow white. According to *Bindheim's* analysis it contains, Silica 57, Alumina 35, Oxide of Iron and Manganese 5. Found in *Siberia*.

#### VARIETY I. CRYSTALLISED.

a. In diverging striated prisms with trihedral summits.

#### SPECIES XX. AMETHYST.

The colour of the amethyst, which is by several authors considered as a variety of rock crystal, is violet blue of different degrees of intensity. When crystallised it usually occurs in hexahedral prisms with corresponding pyramids. It is more or less transparent, and causes a double refraction. Its fracture generally conchoidal, sometimes splintery or coarsely fibrous. It gives sparks very plentifully with steel. Its specific gravity from 2.651 to 2.657. It is infusible at 160 *Wedgw.* but loses its colour and becomes shivery, and by the assistance of oxygen gas may be converted into an enamel. According to *Acbard* it contains, Alumina 60, Silica 30, Lime 8.22, Oxide of Iron 1.66.

Found principally in *Hungary, Germany, Sweden, Mexico, and Ceylon*.

#### VARIETY I. CRYSTALLISED.

CIX. a 1. In short transparent hexahedral prisms with corresponding pyramids, partially frosted with minute crystals of yellow pearl spar, on the surface of an amorphous mass of the same. *Hungary.*

*R. de L. Pl. 6. Fig. 22, 23.*

CX. a 2. In hexahedral pyramids of a deeper colour, with very short corresponding prisms, lining the hollow of a flinty nodule. *Oberstein.*

CXI. a 3. The same in smaller crystals. *Same place.*

CXII. a 4. In large aggregated hexahedral pyramids. *Same place.*

CXIII. b 1. A polished slab of white quartz, on the surface of which appear the inverted pyramids of amethystine crystals. *Hungary.*

CXIV. b 2. In a confused crystalline mass, filling the hollow of a portion of a flinty nodule cut and polished. *Oberstein.*

VARIETY II. *AMORPHOUS.*

CXV. *a* 1. Amethyst forming veins in a slab of white quartz, cut and polished.

*Saxony.*

CXVI. *b* 1. In an irregular mass cut and polished on one side.

CXVII. *b* 2. In detached portions cut and polished.

SPECIES XXI. *QUARTZ.*

Under this head are comprehended the mountain or rock crystal, and quartz commonly so called. It occurs either without colour, or of a white, greyish, reddish, yellowish, greenish, brownish, or blackish colour, with more or less transparency. Its form when crystallised the dodecahedron with triangular faces, or double hexahedral pyramid with or without an intermediate prism; its fracture vitreous, often splintery; refraction double; specific gravity from 2.64 to 2.67. It is brittle, and gives fire plentifully with steel. It is not acted upon by any acid except the fluoric. It is infusible *per se*, and by the assistance of oxygen gas is merely softened; but yields to alkalis with effervescence, to borax slowly and without effervescence. According to the analysis of *Bergman* it contains, Silica 93, Alumina 6, Lime 1. It is found every where in great abundance, being a principal constituent part in the composition of primitive rocks.

VARIETY I. *CRYSTALLISED.*

CXVIII. *a* 1. In transparent double hexahedral pyramids, covering the surface of red hematite.

*Lancashire.*

*R. de L. Pl. 6. Fig. 19.*

CXIX. *a* 2. The same, in smaller crystals, opaque and of a red cornelian colour, some of the crystals having short intermediate prisms, imbedded in red gypsum.

*R. de L. Pl. 6. Fig. 19, 21, 22.*

*Compostella, Spain.*

CXX. *a* 3. In opaque detached crystals of the same figure, of a brownish and white colour.

*Hungary.*

*R. de L. Pl. 6. Fig. 19, 20.*

CXXI. *a* 4. In small brilliant and transparent crystals of the same figure.

*Marmaroch, Hungary.*

CXXII. *a* 5. In detached transparent crystals with longer intermediate prisms:

*Bristol.*

CXXIII.

CXXXIII. *a* 6. The same, semitransparent, scabrous and of a whitish colour, forming a small irregular group, interspersed with grey antimonial ore. *Hungary.*

CXXXIV. *a* 7. In small transparent crystals of a reddish colour, with red hematite, in ferruginous petrosilex. *Bristol.*

CXXXV. *a* 8. In larger detached crystals, semitransparent, having a violet tinge. *Buxton, Derbyshire.*

CXXXVI. *a* 9. In still larger detached crystals of a whitish colour. *Hungary.*

CXXXVII. *a* 10. In small opaque crystals of a brownish yellow colour, on an aggregated mass of the same. *Bristol.*

CXXXVIII. *a* 11. In longer prismatic crystals aggregated into an irregular group, and incrusting on the surface with white calcareous spar. *Hungary.*

CXXXIX. *a* 12. In a solitary crystal with a long intermediate prism, opaque and of a black colour. *Bohemia.*

CXXX. *a* 13. In detached transparent hexhedral prisms, with oblique trihedral summits. *Cornwall.*

CXXXI. *a* 14. The same, in smaller crystals, forming a group on grey quartz, intermixed with yellow pyrites. *Cornwall.*

CXXXII. *a* 15. In a detached transparent hexhedral prism, terminated by an hexhedral pyramid, and enclosing numerous needle-like crystals of green transparent schorl. *Bareges, Pyrenees.*

CXXXIII. *a* 16. The same, of a smaller size, shattery internally, and slightly impregnated with chlorite. *Dauphiné.*

CXXXIV. *a* 17. In transparent detached hexhedral prisms, terminated by trihedral pyramids with pentagonal faces, internally cellular and containing small drops of water. *Hungary.*

CXXXV. *a* 18. In transparent hexhedral prisms with irregular pentagonal pyramids, forming a group on white quartz, the crystals adhering laterally. *Hartz.*

CXXXVI. *a* 19. The same, in smaller crystals, variously inclined and tinged of a topaz colour near their extremities. *Bohemia.*

CXXXVII. *a* 20. In aggregated pyramidal hexhedral crystals, corroded on their surface and incrustated with yellow pyrites. *Hungary.*

CXXXVIII. *a* 21. In transparent prismatic hexhedral crystals, impregnated with chlorite and projecting from ochry quartz. *Dauphinè.*

CXXXIX. *a* 22. In larger flatted crystals, also impregnated with chlorite and irregularly attached to and mortified into each other. *Same place.*

CXL. *a* 23. In short aggregated hexhedral prisms of a whitish colour, with regular hexhedral pyramids. *Cornwall.*

CXLI. *a* 24. Portion of a large transparent hexhedral pyramidal crystal penetrated by prismatic schorl. *Savoy.*

CXLII. *a* 25. In long hexhedral prisms with oblique hexhedral summits, transparent and projecting in different directions from a matrix of ochry quartz. *Dauphinè.*

CXLIII. *a* 26. Forming an assemblage of semitransparent hexhedral prismatic crystals with hexhedral summits, impregnated with green chlorite. *Same place.*

CXLIV. *a* 27. Composed of minute crystals of a paler green colour than the former. *Hungary.*

CXLV. *a* 28. In long transparent diverging prisms, terminated by oblique irregular summits, and having their surfaces covered by numerous smaller crystals applied in a parallel direction, with solitary rhombic crystals of brown pearl spar. *Hungary.*

CXLVI. *a* 29. In hexhedral pyramidal crystals of a reddish tinge, incrustated by minutely crystallised yellowish brown calcareous spar. *Schemnitz.*

CXLVII. *a* 30. In short diverging prismatic crystals, semitransparent and of a reddish colour with yellow pyrites, on galena. *Hungary.*

CXLVIII. *a* 31. In hexhedral prismatic crystals incrustated with minutely crystallised quartz, on a matrix of white quartz. *Saxony.*

CXLIX. *a* 32. In irregular transparent flatted hexhedral crystals, many of them hollow and composed of successive layers, forming a diverging group. *Schemnitz.*

CL. *a* 33. Semitransparent, and of a white colour, forming a lengthened irregular pyramid, on the surface and parallel to the axis of which are implanted numerous short hexhedral prismatic crystals of quartz. *Hungary.*



CLI. a 34. In semitransparent short hexhedral prisms with hexhedral summits, incrufted by crystallised calcareous spar, on white quartz intermixed with brown blende.

*Hungary.*

CLII. a 35. Opaque and of a milk white colour, forming a thick incrustation on rhomboidal calcareous spar, the external surface irregularly crystallised in pyramids.

*Same place.*

CLIII. a 36. In irregular prismatic crystals, capped on their summits by a thick quartz incrustation, and coated by small crystals of transparent hexhedral truncated ponderous spar, on whitish indurated clay.

*Same place.*

CLIV. a 37. In transparent crystals, grouped with black blende, large crystals of galena, covered with yellow pyrites and minutely crystallised cream coloured pearl spar, on indurated talc.

*Same place.*

CLV. a 38. In a transparent hexhedral prism and pyramid, enclosing a smaller crystal of the same figure, rendered opaque by a coating of white talcite.

*Schemnitz.*

CLVI. a 39. In a solitary crystal of a brownish colour, having the pyramids applied to each other obliquely, with a short intermediate prism.

*Bohemia.*

CLVII. a 40. In numerous prismatic crystals, incrufted on the surface with minute shining crystals of grey iron ore.

*Alsace.*

CLVIII. a 41. Forming a transparent cavernous mass, having the septa covered by small hexhedral pyramidal crystals of the same, with yellow pyrites.

*Fürstenberg.*

CLIX. a 42. In lengthened tubercles of a pale rose colour, composed of small pyramidal transparent crystals, on semitransparent quartz intermixed with white ponderous spar.

*Saxony.*

CLX. a 43. In hexhedral pyramids, coated with very minute crystals of quartz, forming a thick semitransparent incrustation on cubic galena.

*Cumberland.*

CLXI. a 44. In semitransparent hexhedral prismatic crystals of a yellowish white colour, terminated at one or both extremities by hexhedral pyramids, very irregularly aggregated and intermixed with minute crystals of white pearl spar, on white quartz.

*Schemnitz.*

CLXII. a 45. Portion of a hollow flinty nodule internally crystallised in hexhedral pyramids of an amethystine colour.

*Oberstein.*

CLXIII. *a* 46. In semitransparent tabulets set edgeways in various directions on amorphous white quartz, the surfaces of the tables covered with minutely crystallised quartz, and partially incrustated with yellowish pearl spar, bearing also on their edges crystallised variegated copper ore, and small hexhedral crystals of calcareous spar having trihedral summits with pentagonal faces. *Near Fribourg in Brisgaw.*

CLXIV. *a* 47. Minutely crystallised, on the surface of irregular tuberous stalactites of the same, of a pale blue colour. *Hungary.*

CLXV. *a* 48. In aggregated short prismatic crystals of a whitish colour, forming an incrustation on larger crystals of the same. *Schemnitz.*

CLXVI. *a* 49. In colourless double hexhedral pyramids obliquely opposed to each other and having short intermediate prisms, in a nodule of argillaceous iron ore. *Colebrook Dale.*

CLXVII. *a* 50. In double hexhedral pyramids with short intermediate prisms of a smoke grey colour, aggregated on the surface of ochry quartz. *Oberstein.*

CLXVIII. *a* 51. In short pyramidal aggregated amethystine crystals externally of a dull red colour, grouped on impure quartz. *Hungary.*

CLXIX. *a* 52. In transparent prisms with corresponding pyramids, on the surface of a tabular quartz incrustation coated with cream coloured pearl spar. *Same place.*

CLXX. *a* 53. In a rounded hollow spherule, covered externally by aggregated pyramidal crystals of the same incrustated with light brown pearl spar. *Cumberland.*

CLXXI. *a* 54. A triangular hollow funnel-shaped incrustation, lined internally by hexhedral pyramidal crystals of a reddish colour on the surface. *Saxony.*

CLXXII. *a* 55. In long hexhedral prismatic crystals variously inclined, on the surface of amorphous quartz impregnated with green chlorite. *Cornwall.*

CLXXIII. *a* 56. In irregular prismatic crystals of a pale flesh colour, incrustated with white opaque calcareous spar, on flesh coloured amorphous pearl spar. *Hungary.*

CLXXIV. *a* 57. In a cavernous shattery mass, having on the surface minutely crystallised quartz with specks of brown blende. *Same place.*

CLXXV. *a* 58. In transparent tubular crystals doubly bevelled at their edges, set edgeways

edgeways on indurated clay impregnated with green chlorite and covered by numerous crystals of adularia.

*Dauphiné.*

*R. de L. Pl. 6. Fig. 30.*

CLXXXVI. *a* 59. In a large transparent double pyramidal crystal, of a light smoke colour, with a short intermediate prism on which the pyramids are placed obliquely, internally of a shattery appearance.

*Switzerland.*

CLXXXVII. *a* 60. In aggregated portions of large hexhedral prisms with corresponding pyramids, semitransparent and of a dark smoke colour.

*Schemnitz.*

CLXXXVIII. *a* 61. A detached pyramid of a large transparent crystal, covered on the surface and impregnated by green chlorite.

*Dauphiné.*

CLXXXIX. *a* 62. In an irregular mass of a white colour, formed by accumulated hexhedral pyramids.

*Cumberland.*

CLXXX. *a* 63. In lengthened irregular aggregated hexhedral prisms, impregnated with green chlorite and incrustated with talcite.

*Dauphiné.*

CLXXXI. *a* 64. Portion of a large transparent crystal also impregnated with chlorite and polished externally.

*Same place.*

CLXXXII. *a* 65. In transparent hexhedral prisms with corresponding pyramids, tinged artificially of a brownish red colour.

*Hungary.*

CLXXXIII. *a* 66. In long transparent hexhedral prisms with corresponding pyramids both having irregular and uneven faces, artificially tinged of a light blue, yellow, and brownish red colour.

*Same place.*

CLXXXIV. *b* 1. In a flatted portion confusedly crystallised, of a white colour and semitransparent, with white pearl spar.

*Dauphiné.*

CLXXXV. *b* 2. In a transparent rounded prismatic portion enclosing brownish capillary schorl.

*Same place.*

CLXXXVI. *b* 3. In minute indeterminate transparent crystals, on white quartz with opaque baroselenite.

*Saxony.*

## VARIETY II. OF PARTICULAR SHAPES.

CLXXXVII. *a* 1. In small detached cubes of a brownish white colour, semitransparent and somewhat spongy.

*Buxton.*

CLXXXVIII.

CLXXXVIII. *b* 1. In large lenticular crystals of a light brown colour, semitransparent and irregularly aggregated, with whitish indurated clay. *France.*

These and the former are crystals of secondary formation.

CLXXXIX. *c* 1. Portion of an irregularly branched incrustation of a bluish grey colour, very minutely crystallised on the surface and incrustated with brown pearl spar. *Hungary.*

CXC. *d* 1. In an irregular cavernous mass of a yellowish brown colour, semitransparent, and minutely crystallised on the surface. *Bristol.*

CXCI. *d* 2. In minute indeterminate crystals of a reddish brown colour, incrusting the surface of hollow pyramidal portions of indurated ferruginous clay. *Hungary.*

CXCII. *d* 3. Of a cellular texture and brownish yellow colour, split on one side into thin laminæ, intersecting each other in various directions, and giving the surface a very irregular appearance. *Same place.*

CXCIII. *d* 4. In a rounded irregular mass of a white colour, hollow internally and minutely crystallised, detached from a portion of flint. *France.*

### VARIETY III. AMORPHOUS.

CXCIV. *a* 1. In an amorphous portion apparently of a foliated texture, semitransparent and of a water colour. *Hartz.*

CXCV. *a* 2. In a quadrangular semitransparent mass also apparently foliated, and of a reddish brown colour. *Hungary.*

*b.* Fibrous.

*c.* Granular.

CXCVI. *d* 1. In an irregular perfectly transparent piece, having a partial brown opaque coating. *Madagascar.*

CXCVII. *d* 2. Of a shattery texture and transparent. *Norway.*

CXCVIII. *d* 3. The same, of a pale rose red colour. *Rabenstein, Bavaria.*

CXCIX. *d* 4. In transparent irregular pieces. *Norway.*

CC. *d* 5. In a polished tablet of a light brown colour enclosing black prismatic schorl. *Bobemia.*

CCI.

CCI. *d* 6. An irregular polished piece of the same, of a purplish tinge.

*Same place.*

CCII. *d* 7. An irregular transparent polished piece, shattery on one side, exhibiting prismatic colours and impregnated with green chlorite.

*Dauphiné.*

CCIII. *d* 8. A smaller specimen of the same.

*Same place.*

CCIV. *d* 9. Thin slabs of white semitransparent quartz, cut and polished. *Sweden.*

CCV. *d* 10. An opake quartz deposit of a spongy texture and whitish colour.

*Reecum, Iceland.*

CCVI. *d* 11. In detached portions tinged green by carbonate of copper.

*Japan.*

#### SPECIES XXII. *PRASE.*

*Prasem, Germ.*

Is of a brownish or yellowish green colour, semitransparent and of a coarse splintery fracture; specific gravity 2.58. When crystallised its form is the same with that of quartz. It gives fire plentifully with steel, and is capable of a fine polish. It has not as yet been analysed, but seems to consist of common quartz impregnated with schorlaceous actynolite.

Found principally in *Silesia, Bohemia, Saxony, and Franconia.*

#### VARIETY I. *CRYSTALLISED.*

*a.* In double hexhedral pyramids with or without an intermediate prism.

*b.* In needle-like crystals.

*c.* Indeterminate.

#### VARIETY II. *AMORPHOUS.*

CCVII. *a* 1. In an irregular mass of an olive green colour and divergingly striated texture.

*Saxony.*

#### SPECIES XXIII. *ELASTIC QUARTZ.*

*Flexible Sandstone.*

Of a greyish white colour, covered with thin scales of grey or brownish mica, and having a small degree of semitransparency. Specific gravity according to *Kirwan* 2.624.

It

It is moderately flexible and elastic, and phosphoresces when scraped with a knife. It is not alterable *per se* at 140 *Wedgw.* but fuses readily with either of the fixed alkalis. By *Klaproth's* analysis it contains Silica 0.965, Alumina 0.025, Oxide of Iron 0.01.

Found hitherto only in the *Brazil* near the diamond mines, and in *Thuringia*.

#### VARIETY I. AMORPHOUS.

CCVIII. *a 1.* In a thin plate of a granular sandy texture, internally of a dull white colour, externally brown and micaceous. *Brazil.*

#### SPECIES XXIV. OBSIDIAN.

*Iceland Agate. Verre Volcanique, Fr.*

This is of a black or greyish or greenish black colour; in thin pieces semitransparent, but in the mass opaque, and of a glossy lustre; its fracture conchoidal; specific gravity 2.348; hardness such as to give fire with steel. It melts easily into a dark grey mass, and according to the analysis of *Bergman* contains Silica 69, Alumina 22, Oxide of Iron 0.09.

Found in *Iceland, Hungary*, and other parts, either in detached masses, or inherent in gneiss, granite, or porphyry.

#### VARIETY I. AMORPHOUS.

CCIX. *a 1.* In an irregular piece, black, opaque, shining, and of a conchoidal fracture. *Iceland.*

CCX. *a 2.* The same, somewhat transparent at the edges. *Isles of Lipari.*

#### SPECIES XXV. CALCEDONY.

The colour of this stone is very various, and on its different tints, shades, and figures, are founded several varieties, of which the chief are, 1st, *Common Calcedony*, the colour of which is generally greyish or bluish: 2d, *Cornelian*, of a wine yellow, flesh red or blood red colour: 3d, *Mocha* with arborisations: 4th, *Onyx* or *Sardonyx*, of a flesh colour and in zones: 5th, *Agate*, zoned and banded, of various colours, and composed of calcedony and jasper: 6th, *Cacholong*, opaque and of a milk white colour.

It generally occurs in mamillated, reniform, stalactitical, botroidal or spherical masses, of moderate size; sometimes also encrusting crystals of quartz or calcareous spar; its external lustre casual; fracture conchoidal, sometimes splintery; specific gravity from 2.606

to

to 2,628; somewhat harder than flint and capable of a high polish. It is infusible *per se* except by the assistance of oxygen gas. At about 150 *Wedgw.* it loses its colour. The fixed alkalis act on it with effervescence, borax readily and without effervescence.

According to *Bergman* the calcedony of *Ferroë* contains Silex 84, Alumine 16, with a small quantity of Oxyde of Iron.

Found in *Iceland, Ferroë, Norway, Scotland, &c.*

#### VARIETY I. OF PARTICULAR SHAPES.

CCXI. *a 1.* In numerous translucent cylindrical stalactites, depending in a parallel direction from the surface of grey flint. *Iceland.*

CCXII. *a 2.* In semitransparent irregular branches, minutely crystallised on the surface. *Cornwall.*

CCXIII. *a 3.* An irregular portion of the same, more compacted and without crystallisation. *Same place.*

CCXIV. *a 4.* In an irregular semitransparent piece of a horny appearance, having the internal surface smooth and mamillated. *Iceland.*

CCXV. *a 5.* The same, in a smaller portion more distinctly mamillated on the surface. *Iceland.*

CCXVI. *a 6.* The same, with the mamillæ still more rounded and projecting. *Same place.*

CCXVII. *a 7.* In semitransparent spherical globules, having the appearance of frog's spawn, on a brown bituminous argillite. *Auvergne.*

CCXVIII. *a 8.* In numerous aggregated tubercles of a bluish white colour, forming an incrustation on coarse opaque quartz. *France.*

CCXIX. *a 9.* In numerous smaller tubercles with arborisations on the surface, forming a white opaque incrustation (*Cacholong*) on a vein of white semitransparent quartz. *Huttenberg, Carinthia.*

CCXX. *a 10.* In an irregular semitransparent piece, enclosing a large mamillary stalactite of the same, opaque and of a whitish colour near the surface. *Iceland.*

CCXXI. *a 11.* Mamillary, semitransparent and of a brownish yellow colour, covering the internal surface of a portion of a hollow flinty nodule. *East Indies.*

CCXXII. *a 12.* In an irregular piece, semitransparent and of a wheyish colour, somewhat mamellated on one surface and angular on the other. *Coast of Antrim.*

*b.* Filiform.

*c.* Tubular.

*d.* Cellular.

## VARIETY II. AMORPHOUS.

CCXXIII. *a 1.* Portion of a thick slab of calcedony, composed of layers of different degrees of transparency and colour, black, white, red, and wheyish. *Iceland.*

CCXXIV. *a 2.* In a slab composed of three layers, the two exterior semitransparent, the interior white and opaque (*Cacholong.*) *Iceland.*

CCXXV. *a 3.* In a thin polished slab, semitransparent and of a milky colour, with veins of yellow and red cornelian. *East Indies.*

CCXXVI. *a 4.* Portion of a nodule of semitransparent red cornelian, with a brown opaque crust, polished on its internal surface. *Same place.*

CCXXVII. *a 5.* A cornelian of a deeper colour and less transparent, approaching to the nature of jasper, in a thin slab polished on one side. *Same place.*

CCXXVIII. *a 6.* The same altogether opaque, lining the internal surface of a section of a hollow nodule of calcedony. *Same place.*

CCXXIX. *a 7.* In translucent artificially polished portions, somewhat effulgent, one yellowish, the other of a wheyish colour. *Ceylon.*

CCXXX. *a 8.* In an irregular piece, semitransparent and of a reddish colour, with golden mica on the surface. (*Avanturine.*) *Aragon.*

CCXXXI. *a 9.* The same, in a small bead of remarkable lustre. *Same place.*

CCXXXII. *a 10.* In an oval slab of a reddish yellow colour, polished on both surfaces. *Aragon.*

CCXXXIII.



CCXXXIII. a 11. In a thin flatted piece of a silvery micaceous lustre, polished on one side. *Cap de Gute, Spain.*

CCXXXIV. a 12. The same, in a rounded nodule of a whiter colour. *Same place.*

CCXXXV. a 13. In a small circular slab of a brown colour. *Bobemia.*

CCXXXVI. a 14. In a thin semitransparent slab with dark brown arborisations. *(Mocha Stone.) Deux Ponts.*

CCXXXVII. a 15. Section of a nodule of brown semitransparent calcedony, filled internally with red jasper. *Bobemia.*

CCXXXVIII. a 16. Agate, composed of stalactites of calcedony mixed with red jasper. *Same place.*

CCXXXIX. a 17. Section of a nodule of calcedony intermixed with cornelian, and having a brown opaque incrustation. *East Indies.*

CCXL. a 18. The same, composed of concentric veins of calcedony and white and brown jasper, with crystallised transparent quartz in the centre. *(Fortification Agate.) Saxony.*

CCXLI. a 19. Portion of a nodule of red cornelian, enclosing a nucleus of white opaque calcedony. *East Indies.*

CCXLII. a 20. In a flatted portion, composed of thin undulating layers of jasper and calcedony of a grey, red, and brown colour, with crystallised quartz at the edge. *Deux Ponts.*

CCXLIII. a 21. Portion of an agate nodule incrustated with yellow and red jasper, filled internally with white quartz. *Oberstein.*

CCXLIV. a 22. A flatted portion of a mixt mass of amethyst, quartz, calcedony, and jasper. *(Jumble Agate.) Saxony.*

CCXLV. a 23. In a thin slab composed of brownish red jasper cemented by semitransparent calcedony. *Deux Ponts.*

CCXLVI. a 24. Thin slabs of semitransparent calcedony, impregnated with arborescent green chlorite. *Deux Ponts.*

CCXLVII. *a* 25. In an irregular piece, composed of brown calcedony intermixed with red jasper. *Bobemia.*

CCXLVIII. *a* 26. In a flattened portion, containing veins of red jasper and calcedony in transparent quartz impregnated with black schorl. *Same place.*

CCXLIX. *a* 27. In a thin slab composed of veins of quartz, red jasper, and cacholong. *Same place.*

CCL. *a* 28. In thin slabs of semitransparent calcedony, veined with brownish jasper. *Saxony.*

CCLI. *a* 29. In an irregular mass, made up of yellow jasper, brown and red cornelian, calcedony and quartz. *Same place.*

CCLII. *a* 30. Thirty-six varieties of the foregoing, principally from *Oberstein, Deux Ponts, and Bobemia.*

#### SPECIES XXVI. CHRYSTOPRASE.

*Krisopbras, Germ.*

Commonly of a beautiful apple-green colour, changing into greenish white or greenish grey, with a moderate degree of transparency and weak lustre; its fracture even, passing into the splintery; specific gravity from 2.479 to 3.258. It gives fire plentifully with steel. On exposure to the blow-pipe it loses its colour and becomes opaque. At 168 *Wedgw.* it is infusible, but melts by oxygen gas into a whitish compact enamel. With pot-ash it gives a violet-coloured glass, with soda or borax a brown, and with microcosmic salt one of a honey yellow colour. By *Klaproth's* analysis it contains, Silica 0.96, Oxyde of Nickel 0.01, Lime 0.008, Alumina 0.008, Oxyde of Iron 0.008.

Found at *Kosmutz* in *Upper Silesia*, forming veins in serpentine.

#### VARIETY I. AMORPHOUS.

CCLIII. *a* 1. In a flattened irregular semitransparent mass of an apple green colour. *Kosmutz.*

CCLIV. *a* 2. The same, of a pale yellowish green colour. *Same place.*

CCLV. *a* 3. The same, in rounded polished portions of different shades of green. *Same place.*

#### SPECIES

SPECIES XXVII. *HYALITE.**Muller's Glafs.*

Of a pure white colour and semitransparent, or without colour; its fracture even, inclining to conchoidal; specific gravity 2.110; scarcely so hard as to give fire with steel. It is infusible *per se* at 150° *Wedgw.* but yields to mineral alkali. According to *Link's* analysis it contains, Silica 57, Alumina 18, Lime 15, and a little Oxyde of Iron.

Found commonly in rounded masses or grains in basalt and trap. It has lately been found also in serpentine near *Swentuck* in *Silesia*.

VARIETY I. *AMORPHOUS.*

CCLVI. *a* 1. In aggregated transparent drops, on the surface of liver-brown toadstone. *Franckfort on the Maine.*

*b.* Compact.

SPECIES XXVIII. *OPAL.*

Of this may be reckoned two varieties, the effulgent (*Edler Opal*, Germ.) and the dull, (*Gemeiner Opal*, Germ.) The effulgent generally of a pale bluish white colour, sometimes yellow or green; the white often emitting a yellowish, greenish, or reddish splendour, the yellow a fiery, and the green a purple, red, or yellow. The dull is also of various colours, as whitish, bluish, greyish, yellowish, reddish, brownish, or greenish. They are both more or less transparent, and of a conchoidal fracture, but seldom so hard as to strike fire with steel. The specific gravity of the effulgent is, according to *Klaproth*, 2.114; of the common from 1.985 to 2.076. Such specimens as become transparent by immersion in water have received the name of *Hydrophanes*.

The opal is infusible *per se*, but yields readily to mineral alkali, with some difficulty to borax, and scarcely at all to microcosmic salt. By *Klaproth's* analysis the common opal contains, Silica 98.75, Alumina 0.01, Oxyde of Iron 0.01.

The finer kinds are found on a yellowish grey argillite at Mount *Czernizeka* in *Upper Hungary*.

VARIETY I. *AMORPHOUS.*

CCLVII. *a* 1. Of a whitish colour, with a green and purplish effulgence, on the surface of yellowish grey indurated clay intermixed with sand. *Czernizeka, Upper Hungary.*

CCLVIII.

CCLVIII. *a* 2. Small detached polished portions of the same. *Same place.*

CCLIX. *b* 1. In an irregular piece, without effulgence, partly semitransparent, partly opaque (*femi-opal*). *Pecklin, Upper Hungary.*

The opaque, part of this specimen on its being immersed in water becomes transparent, and is therefore said to be hydrophanous.

CCLX. *b* 2. Detached portions of the same. *East Indies.*

CCLXI. *b* 3. Semitransparent and of a horny appearance, forming a vein in yellowish white indurated clay. *Kosmutz, Silesia.*

### SPECIES XXIX. PITCH-STONE.

*Pechstein, Germ. Pierre de Poix, Fr.*

Its colour is olive, mountain, leek or blackish green; greyish black; tile, blood or brownish red; yellowish brown; greyish white, &c. It sometimes also occurs striped, spotted, or marbled. It is generally found amorphous, in a few instances crystallised in hexhedral prisms terminated by trihedral pyramids. In the mass it is opaque, but in thin pieces semitransparent; its fracture imperfectly conchoidal, approaching to the splintery; very brittle; difficult to be scratched, but gives very feeble sparks with steel; specific gravity from 2.049 to 2.39. Of different specimens the analysis varies considerably; they all, however, consist essentially of Silica with from  $\frac{1}{10}$  to  $\frac{1}{2}$  of Alumina, some water, inflammable matter, and oxide of iron. It may be distinguished from opal by the greenness of its lustre, and from jasper by its semitransparency and brittleness. The most striking specimens of this stone are from *Hungary, Saxony, Elba, and Siberia.*

### VARIETY I. CRYSTALLISED.

*a*. In hexhedral prisms, with trihedral pyramids.

### VARIETY II. AMORPHOUS.

CCLXII. *a* 1. Of a dull greenish colour intermixed with brown, and having one surface polished. *Braunsdorf, Saxony.*

CCLXIII. *a* 2. Of a brownish black colour intermixed with white opaque specks, semitransparent at the edges, and of a conchoidal fracture. *Same place.*

This probably the same with the dull brown pitchstone of Saxony, which Mr. *Weigleb*

*Weigleb* found to contain, Silica 73, Alumina 18, Oxide of Iron 5.8, with some Water and Air.

CCLXIV. *a* 3. Of a greenish colour intermixed with dull red, semitransparent, and of a vitreous fracture. *Meissen, Saxony.*

CCLXV. *a* 4. Of a brownish red colour. *Telkobanya, Upper Hungary.*

CCLXVI. *a* 5. Of a pale yellowish brown colour, semitransparent throughout. *Meissen, Saxony.*

CCLXVII. *a* 6. Of a brownish yellow colour opaque and of a conchoidal fracture. *Upper Hungary.*

CCLXVIII. *a* 7. Of a dull brownish yellow colour inclining to green and opaque, with reddish brown spots. *Meissen.*

CCLXIX. *a* 8. Of a brownish green colour intermixed with black spots, semitransparent and of a vitreous fracture. *Same place.*

CCLXX. *a* 9. In irregular opaque nodules of a brown colour, tinged blue on the surface and imbedded in dull white indurated clay. *Mesnilmontant.*

*b.* Slaty.

CCLXXI. *c* 1. Composed of thin, opaque, compacted or parallel layers, some whitish, but mostly of a brownish red colour. (*Ligniform or Holz Opal.*) *Telkobanya.*

### SPECIES XXX. CATS-EYE.

*L'œil de Chat, Fr.*

This stone occurs in rounded fragments of various colours, as whitish reflecting a blue effulgence, brown reflecting a whitish effulgence, violet and smoke yellow reflecting a splendid white. It resembles the eye of the animal from which it takes its name, in exhibiting a number of concentric coloured circles surrounding a luminous point. In some directions its fracture is foliated, in others fibrous, but generally conchoidal. It gives fire readily with steel; specific gravity from 2.56 to 2.66. It fuses, though with difficulty, into a white enamel. By *Klaproth's* analysis the variety from *Ceylon* consists of, Silica 95, Alumina 1.75, Lime 1.5, Oxide of Iron 0.25. That from *Malabar* of, Silica 94.5, Alumina 2, Lime 1.5, Oxide of Iron 0.25.

### VARIETY

VARIETY I. *AMORPHOUS.*

CCLXXII. *a* 1. In an irregular portion, of a yellowish red colour, conchoidal fracture, and refulgent surface. *Persia.*

CCLXXIII. *a* 2. In polished detached portions of different colours and sizes. *Egypt, Persia, and Ceylon.*

SPECIES XXXI. *FLINT.*

*Caillou, Fr. Feuerstein, Germ.*

This stone, said to be sometimes crystallised in double trihedral pyramids, occurs generally in amorphous masses or nodules of a smoky or yellowish grey, reddish, brown, or black colour, and often several of these in the same specimen forming veins, stripes, clouds, or dots. Its surface is usually covered with an argillaceous or calcareous crust; internally for the most part semitransparent, with little lustre. Fracture conchoidal, fragments very angular; specific gravity from 2.58 to 2.63; gives fire plentifully with steel. When heated it decrepitates, and becomes white and brittle. It is infusible at 168 *Wedgw.* and barely softened by a stream of oxygen gas. The alkaline fluxes convert it into glass. According to *Weigleb's* analysis it consists of, Silica 80, Alumina 18, Lime 2. The black flint *Klaproth* has found to contain, Silica 98, Lime  $\frac{1}{2}$ , Alumina  $\frac{1}{2}$ , Oxide of Iron  $\frac{1}{4}$ .

Flint is most commonly found in chalk hills, either in solitary masses, or in beds alternating with the chalk.

VARIETY I. *CRYSTALLISED.*

*a.* In double trihedral pyramids.

VARIETY II. *OF PARTICULAR SHAPES.*

CCLXXIV. *a* 1. In irregular stalactites formed on a nodule of flint, of a smoke grey colour, and ochry on the surface. *Kent.*

VARIETY III. *AMORPHOUS.*

CCLXXV. *a* 1. In a round hollow nodule of a smoke grey colour, with a white opake incrustation. *Kent.*

CCLXXVI.

CCLXXVI. *a* 2. Section of a femitransparent nodule of a brownish grey colour, with opake white specks, polished on both sides. *Hampshire.*

CCLXXVII. *a* 3. Portions of the same, in a rough state, covered by a white crust. *Same place.*

CCLXXVIII. *a* 4. In a thin polished slab, of a whitish grey colour intermixed with red. *Hampstead.*

CCLXXIX. *a* 5. Portion of a spherical nodule of a pale brown colour, with crystallised white quartz in the centre. *Surry.*

CCLXXX. *a* 6. Section of a spherical nodule of a dark brown colour, with a semilunar white vein, and thickly incrustated with white indurated clay. *Same place.*

CCLXXXI. *a* 7. In an irregular piece, approaching to the nature of Pitchstone, composed of veins of a dull white colour imbedded in white indurated clay. *Brittany.*

CCLXXXII. *a* 8. Of a bluish grey colour, dendritical on the surface. *Kent.*

*b.* Interspersed.

## SPECIES XXXII. HORNSTONE.

*Petro-Silex, Chert. Hornstein, Germ.*

Is of a blue, yellow, grey, red, brown or green colour of various shades and always amorphous, the crystallised hornstone found lately in certain parts of *Saxony* being most probably only secondary crystals, taking their form from calcareous spar or fluor. Its transparency, lustre and hardness are inferior to those of flint. It is also of a coarser grain; its fracture splintery, rarely conchoidal; specific gravity from 2.532 to 2.653. It is generally infusible *per se*, but with borax or microcosmic salt gives a black glass. A fusible greenish white hornstone from *Lorraine* afforded Mr. *Kirwan* Silica 72, Alumina 22, Carbonate of Lime 6.

Found only in primitive mountains.

## VARIETY I. CRYSTALLISED?

*a.* In hexedral prisms with or without pyramids?

*b.* In double trihedral pyramids?

*c.* In cubes?

O

VARIETY

## VARIETY II. AMORPHOUS.

CCLXXXIII. *a* 1. In an irregular portion, compact and of a brownish white colour.  
*Deva, Transylvania.*

CCLXXXIV. *a* 2. The same of a coarser texture, and of a grey colour intermixed with red.  
*France.*

CCLXXXV. *a* 3. In a flatted piece, composed of semitransparent layers of a brownish red colour, partaking of the nature of flint.

CCLXXXVI. *a* 4. Portion of an opaque nodule, of a dull white colour, enclosing a nucleus the surface of which is minutely crystallized.  
*Hampshire.*

CCLXXXVII. *a* 5. Five other varieties of hornstone, polished on the surface.

CCLXXXVIII. *a* 6. In a tabular portion of a very fine grain and compact texture, of a bluish black colour (*Lydian Stone*).  
*Saxony.*

This reckoned by *Baron Born* as a variety of Basalt. *Catal. de Raab. X. B. 3.*

*b.* Slaty. (*Siliceous Schist*. *Basanite*.) *Anal.* Silice 75, Lime 10, Magnesia 0.046, Iron 3, Coal 5. *Weigl.*

*Hornslate.* *Anal.* Silice 73, Alumine 24, Iron 3. *Weigl.*

## SPECIES XXXIII. JASPER.

The colours of this stone are various, as white, grey, yellow, brown, red, and green of different shades, and frequently several of these mixed in spots, clouds, veins, or stripes. It is of considerable splendour; its fracture generally conchoidal, passing into the splintery or earthy. It breaks into irregular sharp angular pieces. It is in the mass opaque, but in thin fragments sometimes semitransparent. Though inferior in hardness to flint, it gives fire with steel. Its specific gravity from 2.58 to 2.7. In the fire it changes colour, but does not decrepitate nor harden, neither at 156 *Wedgw.* does it shew any signs of fusion: even by oxygen gas it is very imperfectly melted. Alkalis and microcosmic salt flux it difficultly, borax more easily, and without effervescence. According to the analysis of *Delamethrie*, the Egyptian pebble, which is a variety of jasper, contains, Silice 54, Alumine 30, Iron 16.

Jasper



Jasper is met with in various parts of the world, in large elliptical masses connected by veins, or in detached nodules, or forming entire rocks.

### VARIETY I. CRYSTALLISED?

a. In irregular hexedral prisms?

Most probably secondary crystals formed on calcareous spar.

### VARIETY II. AMORPHOUS.

CCLXXXIX. a 1. In an uniform mass of a dull red colour.

*Calverberg, Hungary.*

CCXC. a 2. In a polished portion of a dull clouded green colour. *Egypt.*

CCXCI. a 3. Of a flesh red colour, intersected with whitish veins and mixed with angular fragments of crystallised quartz. *Bohemia.*

CCXCII. a 4. Composed of chocolate brown and leek green parallel veins. *Siberia.*  
(*Ribbon Jasper.*)

CCXCIII. a 5. Exhibiting irregular veins or clouds of red and olive green of various shades. *Same place.*

CCXCIV. a 6. Of a purplish colour, intermixed with brown and white spots, and having somewhat of a granular texture, intermediate between Jasper and Quartz. *Bohemia.*

CCXCV. a 7. Of a cloudy blood red colour, and intermixed with small portions of white quartz. *Same place.*

CCXCVI. a 8. Of an uniform blood red colour. *Same place.*

CCXCVII. a 9. Of a pale yellowish cloudy green colour, with streaks of grey iron ore. *Same place.*

CCXCVIII. a 10. Of an uniform yellowish green colour. *Borna.*

CCXCIX. a 11. In green and yellow veins with a reddish cloud. *Bohemia.*

CCC. a 12. Composed of reddish brown and light greenish yellow parallel veins. *St. Kolm Ktln, Scotland.*

- CCCI. *a* 13. Of a light liver brown colour. *Samoy.*  
CCCII. *b* 1. Egyptian Pebble in thin slabs, cut and polished.  
CCCIII. *b* 2. Seventeen other varieties of the same, of various colours and sizes.  
Principally from *Bohemia*, one from *Otakeite*.

SPECIES XXXIV. PORCELANITE.

*Porzellan Jaspis*, Germ.

Its colours are yellowish or pearl grey, lavender blue, ochre yellow, straw or Isabella yellow, tile or flesh red, reddish brown or greyish black; many of these occurring in distinct spots in the same specimen. It is opaque, and of a moderate splendour; fracture conchoidal inclining to even, with sharp angular fragments and disposition to split into layers; brittle; hardness nearly the same with that of jasper; specific gravity 2.33. At 151 *Wedgw.* it melts into a spongy semitransparent mass. It has not as yet been analysed.

Found in large masses in various parts of *Germany*.

VARIETY I. AMORPHOUS.

- CCCIV. *a* 1. In a flatted piece of a lilach colour having one side polished.  
*Germany.*

- CCCIV. *a* 2. Composed of layers of a light olive green colour, superficially of a brownish red.  
*Hungary.*

SPECIES XXXV. HELIOTROPIMUM.

*Jasp Sanguin*, Fr.

It occurs in amorphous masses of a green colour of various shades, with spots of blood red or ochre yellow, has little lustre, and may be distinguished from jasper by its faint degree of transparency. Its fracture flatly conchoidal passing into the splintery. It gives fire very plentifully with steel; specific gravity from 2.62 to 2.7. At 114° *Wedgw.* it assumes a reddish brown tinge, and, according to *Lavoisier*, is scarcely fusible by the aid of oxygen gas. It is found in *Egypt*, *Siberia*, *Iceland*, &c.

*Born* considers the heliotrope as a variety of agate.

VARIETY

VARIETY I. AMORPHOUS.

CCCVI. *a* 1. In a polished piece, of a dark green colour, intermixed with brown veins and red spots. *Asia.*

CCCVII. *a* 2. Three polished slabs of the same.

SPECIES XXXVI. WOODSTONE.

*Bois Petrifié, Fr. Holzstein, Germ. Litboxylon.*

This stone differs in its colour, shape, magnitude, texture, transparency, &c. according to the kind of wood from which it has originated. It is generally of a grey, brown, yellow, reddish, whitish, or black colour; but slightly transparent and with little lustre; so hard as to give fire plentifully with steel; fracture conchoidal; specific gravity from 2.045 to 2.675. It has not been analysed, but appears to be of the nature of quartz.

It is found in great variety in the island of *Martinico*, *Hungary*, and various other parts.

VARIETY I. AMORPHOUS.

CCCVIII. *a* 1. In an oblong piece, of a pale brown colour with black and white clouds, having one side polished. *Bohemia.*

CCCIX. *a* 2. Of a darker brown and more uniform colour, also polished. *Upper Hungary.*

CCCX. *a* 3. Of a brownish white colour. *Same place.*

SPECIES XXXVII. FELSPAR.

Its most common colour is flesh red, sometimes bluish grey, not unfrequently yellowish, greenish, or milk white, or brownish yellow, rarely blue or green, only in one instance black, and sometimes altogether without colour. Its transparency is of different degrees from perfectly transparent to opaque; lustre considerable, sometimes unctuous, in the more transparent, pearly and iridescent; its fracture generally foliated; fragments rhomboidal; specific gravity from 2.437 to 2.600. When crystallised it occurs in rhomboids or tetrahedral prisms, truncated obliquely, and their varieties. It gives sparks feebly



feebly with steel, and may in many instances be scratched by a hard knife. Its different varieties are fusible at from 119 to 130 *Wedgw.* Alkalis flux it with difficulty, microcosmic salt and borax more easily. From the analysis of *Gerbard, Weigleb, Heyer, Saussure, Kirwan*, and others, it contains, Silica 43—79, Alumina 12—37, in some instances Magnesia 4—9, Baryte 2—11, Lime 2—17, Oxide of Iron 1—3. According to *Kirwan* any compound of silica and alumina in which the former predominates, with a sufficient proportion of lime and magnesia, or lime, magnesia and baryte to render the mixture fusible at 140 *Wedgw.* may constitute felspar. It is found in great abundance, as it forms a principal constituent part of granite and porphyry, and is also sometimes met with in nests and veins in secondary mountains. By long exposure to the atmosphere it often suffers decomposition, and is thereby productive of a whitish infusible clay.

### VARIETY I. CRYSTALLISED.

CCCXI. *a. aa* 1. In semitransparent flattened aggregated tetrahedral prisms obliquely truncated at each extremity, and covered with capillary amianthus. (*Adularia.*)

*Mount St. Gotthard.*

CCCXII. *a. aa* 2. In white transparent flattened hexhedral prisms terminated by tetrahedral summits, implanted on opaque micaceous quartz.

*Pyrennées.*

*R. de L. Pl. 5. Fig. 14.*

CCCXIII. *a. aa* 3. The same, with brown lenticular spathose iron ore and crystallised quartz.

*Dauphiné.*

CCCXIV. *a. aa* 4. The same, in very numerous crystals of a reddish yellow colour, on reddish ferruginous quartz.

*Same place.*

CCCXV. *a. aa* 5. In minute transparent crystals with white silky amianthus.

*Pyrennées.*

CCCXVI. *a. aa* 6. In larger polyhedral crystals on an ochry calcareous incrustation.

*Same place.*

CCCXVII. *a. aa* 7. The same, in larger crystals.

*Same place.*

CCCXVIII. *a. aa* 8. Fragment of a large semitransparent crystal.

*Mont St. Gotthard.*

CCCXIX. *a. aa* 9. Detached transparent polished portions of the same.

*Same place*

CCCXX.

CCCXX. *a. aa* 10. In a compact semitransparent and effulgent mass, of a white colour and foliated texture. *Pyrennées.*

CCCXXI. *a. bb* 1. In tetrahedral prisms of a pale flesh red colour, truncated obliquely at their extremities, (*Common Felspar.*) *Lago de Corno.*

CCCXXII. *a. bb* 2. In smaller crystals of a dull white colour, truncated both at the edges and extremities, and imbedded in coarse decomposing granite. *Auvergne.*

CCCXXIII. *a. bb* 3. The same, in detached crystals of different sizes, some truncated, others entire. *Same place.*

CCCXXIV. *a. bb* 4. In aggregated rhombs of a scaly texture and light yellow colour, with smoky crystallised quartz and silvery mica. *Dauphinè.*

## VARIETY II. AMORPHOUS.

CCCXXV. *a* 1. Of a foliated texture and brownish red colour, with veins of quartz.

CCCXXVI. *a* 2. Of a pale reddish white colour and shining surface. *Alps.*

CCCXXVII. *a* 3. The same, of a milk white colour, with a reddish tinge and angular fracture. *Savoy.*

CCCXXVIII. *a* 4. In an irregular foliated mass, partly of a light brown colour and partly white, much of the latter in a powdery or decomposing state.  
Said to be rich in silver. *Jobngeorgenstadt.*

CCCXXIX. *a* 5. Of a pale verdigris green colour, splendid on the surface, and intersected transversely with small white veins. *Siberia.*

CCCXXX. *b* 1. Of a yellowish white colour and granular texture, approaching to the nature of quartz. *Scotland.*

CCCXXXI. *b* 2. Of a close granular texture and yellowish red colour (*Red Petunse.*)  
*Pentland-Hill near Edinburgh.*

CCCXXXII. *c* 1. Of an angular fracture and light reddish yellow colour.  
This used in making china. *Same place.*

CCCXXXIII. *c* 2. Of a very pale purplish flesh colour, compact, and of a somewhat slaty texture and angular fracture. *China.*

## SPECIES

## SPECIES XXXVIII. LABRADOR FELSPAR.

Its colour is of a light bluish or blackish grey or green, reflecting in different positions blue, purple, red, green, &c. Its form amorphous; texture foliated; fragments rhomboidal; specific gravity from 2.67 to 2.69; transparency and hardness nearly the same with those of common felspar. It fuses with difficulty at 155 *Wedgw.* separating into a white and brown mass, the latter less fusible than the former. According to *Bindheim's* analysis, the green felspar of *Siberia*, which is of this species, consists of Silica 69, Alumina 13, Sulphate of Lime 12, Oxyde of Copper 0.7, Oxyde of Iron 0.04.

Found principally in *St. Paul's Island, Coast of Labrador, North America*, where it occurs in rounded masses, and is thought to form a constituent part of granite.

## VARIETY I. AMORPHOUS.

CCCXXXIV. *a* 1. Of a foliated texture, semitransparent and exhibiting a red and blue effulgence. *Coast of Labrador.*

CCCXXXV. *a* 2. The same, with a blue effulgence. *Same place.*

CCCXXXVI. *a* 3. In thin polished slabs, one exhibiting a blue, the other a green effulgence. *Same place.*

CCCXXXVII. *a* 4. The same, in larger slabs. *Same place.*

CCCXXXVIII. *a* 5. The same, in smaller portions with blue stripes. *Same place.*

CCCXXXIX. *a* 6. The same, with green stripes. *Same place.*

## SPECIES XXXIX. PETRILITE.

*Cubic Felspar, Karsten.*

Described by *Kirwan* as being of a reddish brown or brownish red colour, of a weak lustre and little transparency; amorphous; fracture splintery or foliated; fragments cubic; hardness equal to that of the softer felspars; brittle; specific gravity 3.081. At 160 *Wedgw.* becomes white, barely concreting without fusion.

## VARIETY I. AMORPHOUS.

[ *a*. With cubic fragments.

SPECIES

## SPECIES XL. ARGENTINE FELSPAR.

*Oculus Piscis.*

This stone appears to be little else than a variety of felspar in a state of decomposition. It occurs either amorphous, or in rounded fragments, or crystallised as common felspar; its colour either common, dead, or silvery white, or, according to the degree of decomposition, iridescent or ochry yellow, and also, according to the directions of its fracture, of a foliated or striated texture, with but little transparency; generally softer than common felspar; specific gravity from 2.212 to 2.500. It fuses without much difficulty into a clear compact mass; and, by the analysis of *Dodun*, who first discovered it in the black mountains of *Languedoc*, contains Silica 46, Alumina 36, Oxide of Iron 16.

## VARIETY I. CRYSTALLISED.

a. As common felspar.

## VARIETY II. AMORPHOUS.

a. Foliated.

## SPECIES XLI. FELSITE.

Differs principally from common felspar in being of a compact texture and extremely difficult of fusion. Its colour is for the most part azure blue, or green, and sometimes, as it is said, brownish. When exposed to the blowpipe it whitens and becomes splintery, but has not yet been analysed. It was first discovered in the mountains of *Styria* intermixed with quartz and mica. The green kind enters also into the composition of a particular species of porphyry.

## VARIETY I. AMORPHOUS.

CCCXL. a 1. Of a light sky blue colour and compact texture, with white quartz, and silvery mica. *Dauphiné.*

SPECIES LXII. *STAUROLITE.**Andreasbergolite, Wern. Kreutz Crystal.*

This occurs in semitransparent crystals generally of a milk white colour, and having a considerable degree of lustre. Its form flattened tetrahedral prisms terminated by tetrahedral pyramids, its crystals either single or crossing each other at right angles; texture foliated; brittle, but of sufficient hardness to give a few feeble sparks with steel; specific gravity from 2.355 to 2.361. It is slightly acted on by acids. On being gradually heated it decrepitates and loses from 15 to 16 parts of its weight. It is infusible at 150° *Wedgw.* but by the assistance of oxygen gas may be converted into a white enamel; by borax or microcosmic salt it is reduced with difficulty into a porous opaque and greenish mass, and by soda into a frothy one of a white purplish or yellowish colour. According to the analysis of *Westrumbe* it contains, Silica 44, Alumina 20, Barytes 20, Water 16.

Found at *Andreasberg* in the *Hartz*, near *St. Brieux* in *France*, and *Compostella* in *Spain*. By many it is considered as only a variety of zeolite.

VARIETY I. *CRYSTALLISED.*

CCCXLI. *a 1.* In tetrahedral prisms with tetrahedral pyramids, some single, others crossing each other at right angles, semitransparent and irregularly aggregated on the surface of an amorphous mass of the same. *Hartz.*

CCCXLII. *a 2.* The same, in milky coloured crystals, covering the surface of a portion of an internally crystallised geod. *Oberstein.*

CCCXLIII. *a 3.* In larger crystals, on the surface of a mass of calcareous spar. *Scotland.*

SPECIES XLIII. *LAPIS LAZULI.*

A stone which exhibits various shades of azure blue mixed with spots of white, and veins or specks of yellow pyrites, which have been occasionally mistaken for native gold. Its form amorphous; surface dull; fracture almost earthy; opaque; specific gravity from 2.76 to 2.94. It gives fire feebly with steel, and is capable of a fine polish. It retains its colour at 100° *Wedgw.* but in higher degrees of heat melts with intumescence into a yellowish black mass, and afterwards into a whitish enamel. When previously calcined it is converted by the mineral acids into a gelatinous substance.

It



It appears to derive its colour from Oxyde of Iron, as it contains, according to the analysis of *Margraff*, Silica, Lime, Sulphate of Lime, and Iron; and according to *Klaproth*, Silica 46, Alumina 14.5, Carbonate of Lime 28, Sulphate of Lime 6.5, Oxyde of Iron 3, Water 2.

Found on the frontiers of *Siberia*, *Tartary*, and *China*, and lately, as is reported, in *America*.

VARIETY I. AMORPHOUS.

CCCXLIV. *a* 1. In a polished fragment of a Prussian blue colour, intermixed with white quartz and silvery mica. *Asia*.

CCCXLV. *a* 2. Two fragments, one of a lavender, the other of a skyblue colour, both intermixed with quartz. *Same place*.

CCCXLVI. *a* 3. Five polished portions of the same, of various shades.

SPECIES XLIV. PREHNITE.

This stone occurs either amorphous, or crystallised in compressed tetrahedral prisms; its colour apple green or greenish grey; semitransparent and internally of a slight pearly lustre; texture foliated; brittle; hardness such as to give fire with steel; specific gravity 2.942. When heated to redness it swells even more than zeolite, and under the blow-pipe melts into a brown spongy enamel. With alkalis it forms also an enamel; with microcosmic salt an opalescent, and with borax a clear glass. According to the analysis of *Klaproth* it contains, Silica 44, Alumina 30, Lime 18, Oxyde of Iron 5, Water and Air 2.

First found at the *Cape of Good Hope* by *Col. Prehn*: found also near *Dumbarton* in *Scotland* and *Dauphiné* in *France*.

VARIETY I. CRYSTALLISED.

CCCXLVII. *a* 1. In compressed transparent tetrahedral prisms of a pale green colour, with crystals of violet fluor and ponderous spar, on dark green argillaceous schistus. *Dauphiné*.

CCCXLVIII. *a* 2. The same, in smaller aggregated crystals, superficially impregnated with greenish actynolite, on a similar matrix. *Same place*.

*b*. Indeterminate.

## VARIETY II. AMORPHOUS.

CCCXLIX. *a* 1. In a semitransparent tuberous mass of an apple green colour and foliated texture, indistinctly crystallised on the surface. *Cape of Good Hope.*

SPECIES XLV. *ÆDELITE.*

*Siliceous Zeolite.*

A stone of a light grey colour, sometimes with a slight tinge of red, brown, green, or yellowish green; of a tuberosc or knotty form, with little lustre, and of a striated and sometimes splintery fracture. Specific gravity 2.515. It gives fire readily with steel, melts with intumescence under the blow-pipe into a frothy mass, and according to the analysis of *Bergman* contains Silica from 62 to 69, Alumina from 18 to 20, Lime from 8 to 16, Water from 3 to 4.

Hitherto found only at *Adelfors* and *Messenberg* in *Sweden*. On account of its hardness and specific gravity, it is denied by *Kirwan* to be a variety of zeolite.

## VARIETY I. OF PARTICULAR SHAPES.

*a.* Tuberosc.

SPECIES XLVI. *ZEOLITE.*

Occurs most commonly in crystals, rounded masses, or grains, either enclosed in amygdaloid (*Toadstone* as it is generally called) or in the fissures of rocks. Its most usual colour is pure, yellowish, or greenish white, sometimes reddish white, and more rarely greenish grey, honey, or orange yellow, or flesh red. When crystallised, its forms are either cubes and their varieties, truncated hexedral prisms, or hexagonal lamellæ; the external surface of its crystals smooth, with a considerable degree of splendour, which varies internally from mother-of-pearl to vitreous; its fracture fibrous and radiated, or curvately foliated, sometimes coarsely granular; fragments irregularly angular and not remarkably sharp; transparency varying from clear to semitransparent at the edges only; specific gravity from 2.07 to 2.21; readily scratched by the knife. By the mineral acids it is, in most instances, converted into a kind of jelly. Under the blow-pipe it becomes white, opaque and intumescent. Before fusion it emits a blue phosphoric light, and when melted forms a white semitransparent frothy enamel, not sufficiently hard to cut glass, and soluble in acids. Its fusion is promoted by soda, borax,

rax, and microcosmic salt; by the first more readily, than by either of the others. The zeolite of *Iceland*, according to *Bergman's* analysis, contains Silica 48, Alumina 22, Lime 14, Water 16. That of *Ferroë*, according to *Pelletier*, Silica 50, Alumina 20, Lime 8, Water 22.

Most zeolites are observed to be subject to decomposition on exposure to air, and said to be often found passing into calcedony.

### VARIETY I. CRYSTALLISED.

CCCL. *a* 1. In small rhomboidal crystals of a white colour and semitransparent, on brown basalt. *Scotland.*

CCCLI. *a* 2. In semitransparent rhomboids of a white colour, some perfect, others variously truncated, on the surface of greyish toadstone. *Same place.*

CCCLII. *a* 3. The same, in crystals of a whiter colour. *Same place.*

CCCLIII. *a* 4. The same, of a light brownish yellow colour, on the surface of greenish black basalt. *Same place.*

*b*. In truncated hexahedral prisms.

CCCLIV. *c* 1. In lengthened hexagonal lamellæ, transparent and of a white colour; some of the crystals perfect, others doubly bevelled at the edges, with cubic crystals and small spherules of the same, on brownish yellow toadstone. *Ferroë.*

CCCLV. *c* 2. In small transparent hexagonal plates, on a flattened incrustation of the same. *Same place.*

CCCLVI. *c* 3. In flattened tetrahedral prisms terminated by tetrahedral pyramids, semitransparent, and of a mother-of-pearl lustre, composed of hexagonal lamellæ accumulated one on the other, on a yellowish brown argillite. *Iceland.*

CCCLVII. *c* 4. The same, in smaller crystals, more confusedly aggregated. *Same place.*

CCCLVIII. *c* 5. The same, forming concave aggregated fasciculi, on a brownish zeolitic incrustation. *Same place.*

CCCLIX. *c* 6. In smaller hexagonal crystals, aggregated, on the surface of a rhomboidal fragment of transparent double refracting calcareous spar. *Iceland.*

CCCLX.

- CCCLX. c 7. In more confusedly aggregated crystals. *Iceland.*
- CCCLXI. c 8. The same, in rather larger crystals, *Same place.*
- CCCLXII. c 9. In tetrahedral prismatic crystals, semitransparent and of a white colour, diverging from different centres. *Same place.*
- CCCLXIII. c 10. In small hollow internally crystallised nodules, in light liver brown toadstone. *Isle of Sky.*
- CCCLXIV. c 11. The same, in more compact nodules, in deep brown toadstone. *Same place.*
- CCCLXV. c 12. In aggregated hexagonal laminæ, lining the cavity of a rounded nodule of the same. *Ferro.*
- CCCLXVI. d 1. Composed of aggregated diverging laminæ of a white colour and pearly lustre, with distinct projecting summits. *Norway.*
- CCCLXVII. d 2. A smaller specimen of the same, composed of broader laminæ. *Same place.*
- CCCLXVIII. d 3. In an irregular piece of an opaque white colour, silky lustre and delicate fibrous texture, composed of prismatic crystals diverging from different centres and decussating each other at the surface, intermixed with ochry quartz. *Iceland.*
- CCCLXIX. d 4. In delicate white filaments, producing a velvety appearance and lining the hollow of an irregular piece of the same. *Giant's Causeway.*
- CCCLXX. d 5. The same, in whiter, finer, and more brilliant filaments. *Same place.*
- CCCLXXI. d 6. The same, in a more irregular nodule. *Same place.*
- CCCLXXII. d 7. In delicate silky fibres, forming a downy covering on the surface of a greenish toadstone. *Isle of Sky.*
- CCCLXXIII. d 8. The same, forming a thicker covering on a similar matrix. *Same place.*
- CCCLXXIV. d 9. The same, in longer capillary crystals. *Same place.*

VARIETY

VARIETY II. AMORPHOUS.

CCCLXXV. *a* 1. Of a white colour and compacted fibrous texture, the fibres on the surface decussating each other in the same manner with those of No. 368.

*Norway.*

CCCLXXVI. *a* 2. Of a fibrous texture, forming small stellæ on the surface of a greenish hornblende schist.

*Sweden.*

CCCLXXVII. *a* 3. In diverging aggregated fibres of an ochry yellow colour, on decomposing yellow pyrites.

*Norway.*

CCCLXXVIII. *a* 4. In an irregular flatted nodule, internally of a diverging fibrous texture and snow white colour.

*Iceland.*

CCCLXXIX. *b* 1. Composed of long diverging laminæ, semitransparent and of a white colour, having a cock's comb appearance on the surface.

*Same place.*

CCCLXXX. *b* 2. A smaller portion of the same, with greenish toadstone.

*Same place.*

CCCLXXXI. *b* 3. In layers, composed of loosely aggregated laminæ, lying in different directions on a nucleus of minutely crystallised quartz.

*Norway.*

CCCLXXXII. *b* 4. Portion of a rounded semitransparent nodule, of a foliated texture and white colour.

*Iceland.*

CCCLXXXIII. *c* 1. Of a compact texture and light greenish yellow colour, tubercle on the surface.

*Scotland.*

CCCLXXXIV. *c* 2. In a compact mass of a yellowish white colour, silky lustre, and opaque, forming a broad vein in semitransparent calcedony.

*Norway.*

CCCLXXXV. *c* 3. In a rounded mass, hard, semitransparent, and of a yellowish green colour, intermixed with white zeolite, having one surface polished.

*Scotland.*

CCCLXXXVI. *c* 4. In small white opaque spherules, in a reddish brown toadstone.

*Norway.*

CCCLXXXVII. *c* 5. In small semitransparent spherules, imbedded in a dark siliceous cement; the specimen cut and polished.

CCCLXXXVIII. c 6. In an irregular compact semitransparent mass of a pure white colour.

*Giant's Causeway.*

CCCLXXXIX. c 7. Of a tile red colour, intermixed with white quartz.

*Neighbourhood of Upsal, Sweden.*

d. Loose.

#### SPECIES XLVII. SILICEOUS SPAR.

*Saulin Spath, Bindheim.*

Considered by *Bergman* as a variety of zeolite; but by *Kirwan* as a stone of a distinct species, principally on account of its containing so small a proportion of water. It is described as of a white, straw yellow, sea green, mountain green, or light blue colour; its crystals tetrahedral or hexhedral prisms, transversely streaked, of a fibrous or striated fracture and silky lustre, and generally accumulated on each other. It effervesces with acids, and, according to the analysis of *Bindheim*, contains Silica 61.1, Lime 21.7, Alumina 6.6, Magnesia 5, Oxyde of Iron 1.3, Water 3.3.

#### VARIETY I. CRYSTALLISED.

a. In tetrahedral prisms.

b. In hexhedral prisms.

#### SPECIES XLVIII. ROSE SPAR.

*Red Stone of Rawenstein.*

This stone, though said to be found amorphous and in large masses, is sometimes crystallised. Its colour by reflected light is rose red, by refracted blue; its lustre pearly and somewhat iridescent; transparency of different degrees from semitransparent to clear; fracture foliated; fragments rectangular; hardness generally sufficient to give fire with steel; brittle; specific gravity about 4.00. It does not effervesce with acids. When suddenly heated it decrepitates and fuses with great difficulty. The usual fluxes are found to affect it but little.

It is considered by *Mr. Kirwan* as being nearly allied to petrilite.

#### VARIETY

## VARIETY I. CRYSTALLISED?

CCCXC. *a* 1. In an irregularly aggregated crystalline mass, transparent, of a pale rose red colour, pearly lustre, foliated texture, very friable and producing rectangular fragments. *Rawenstein.*

## VARIETY II. AMORPHOUS.

*a*. Thick foliated.

To the foregoing species may be added *Tremolite*, a stone discovered by father *Pini*, at *Mount Tremola* in the neighbourhood of *Mount St. Gotthard*. This occurs, for the most part, in masses of a fibrous texture, the fibres sometimes parallel, sometimes diverging. Its colour white, greyish or blackish, with a pearly lustre and slight transparency; hardness scarcely such as to give fire with steel; specific gravity, 2.65. It is partly soluble in the nitric acid with effervescence; becomes phosphorescent on slight friction; melts by an intense heat into a transparent glass; and is said to consist of *Silex* and *Lime*, with a little *Magnesia*, *Carbonic Acid*, and *Water*.

## GENUS VII. ADAMANTINE EARTH.

A new species of earth which *Klaproth* thought he had discovered in combination with *Silex*, *Oxide of Iron*, and of *Nickel*, in the analysis of *Adamantine Spar*, and remarkable for the properties of being insoluble in acids, and infusible with either of the fixed alkalis.

## SPECIES I. ADAMANTINE SPAR.

This generally occurs in crystals, more or less regular, of a greyish colour, with various shades of green, brown, or black, the greyish being, for the most part, semi-transparent, and having somewhat of a pearly lustre; its texture laminated; hardness equal to that of the *topaz*; specific gravity from 3.71 to 3.87. It is infusible even with the assistance of oxygen gas, and is very difficultly acted on by alkalis.

According to the first analysis of *Mr. Klaproth*, it was said to consist of *Adamantine Earth* 68, *Silex* 31.5, *Iron and Nickel* 00.05; but by subsequent experiments it has been found to contain *Alumine* from 84 to 89, *Silex* from 5.5 to 6.5, *Oxide of Iron* from

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from 1.2 to 7.5, and no new earth of any kind. The chief varieties of this spar come from *India* and *China*, the first generally of a greyish, the latter of a blackish colour, and known by the name of *Corrindon*, or *Corundum*.

#### VARIETY I. CRYSTALLISED.

I. a 1. In a large hexhedral prism, obliquely truncated at both extremities, of a dull yellowish green colour, and changeable lustre, being superficially coated with mica.  
Neighbourhood of *Bombay*.

#### VARIETY II. AMORPHOUS.

II. a 1. In small irregular portions intermixed with purplish micaceous quartz.  
*Same place.*

#### GENUS VIII. JARGON EARTH.

First obtained by *Klaproth* in the analysis of the *Jargon* or *Circon*, in which he found it in combination with *Silex*, and Oxyde of Iron and of Nickel. Its colour is white; its specific gravity estimated at 4.000. With the sulphuric acid it forms an astringent salt with stelliform crystals; with the acetous acid, a salt incapable of crystallization. It is insoluble even in a boiling solution of potash. It melts with borax without effervescence, but is infusible with either of the fixed alkalis, or with microcosmic salt. The order of attraction of this earth has not as yet been sufficiently ascertained.

#### SPECIES I. JARGON.

*Zirkon*, Germ.

The colour of this stone is grey, or greenish white, or yellowish green, or yellowish or reddish brown, or violet; it is sometimes also without colour. Its external lustre casual, its internal inclining to the metallic; its fracture laminated; fragments indeterminate; transparency considerable; refraction double; form double tetrahedral pyramids with or without an intermediate prism; specific gravity from 4.416 to 4.700; hardness next to that of the sapphire.

It is difficultly acted on by acids. When heated to redness and suddenly quenched in water it becomes shattery, but is scarcely fusible even by the help of oxygen gas.

According to *Klaproth*, it contains, Jargon Earth 68, *Silex* 31.5, Oxyde of Iron and of Nickel 0.05. Brought principally from *Ceylon*.

#### VARIETY



VARIETY I. *CRYSTALLISED.*

I. *a* 1. In small octahedral crystals of various shades from colourless to pale sea-green. *Ceylon.*

II. *a* 2. Indeterminate fragments of the same. *Same place.*

*b.* Indeterminate.

GENUS IX. *SIDNEIAN EARTH.*

The substance so called by *Mr. Wedgwood*, and on his authority thought to be a new species of earth, appears by the late experiments of *Mr. Hatchett* to be only a mixture of *Silex*, *Alumine*, and *Oxyde of Iron*. Vide *Phil. Trans. Vol. lxxx. Part ii. P. 306.* and *Vol. lxxviii. Part i. P. 1.*

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ORDER II. *MIXED.*

Compounds of the foregoing earths or stones, having their integrant parts so blended as not to be visibly distinct.

GENUS I. *CALCAREOUS.*

SPECIES I. *MARL.*

*Argillo-calcite.*

This generally occurs in strata more or less extensive, and of different degrees of induration. It is of various colours, without lustre or transparency; when dry has a rough harsh feel; specific gravity from 1.6 to 2.4. It is easily diffusible in water, moulders on exposure to air, effervesces strongly with acids, and is found fusible from 130 to 140 *Wedgw.* By analysis it appears to consist of Carbonate of Lime 60—80, the remainder clay, with a little Oxyde of Iron and other accidental admixtures.

VARIETY I. SEMI-INDURATED.

- I. In an irregular piece of a dead white colour, light and of an earthy texture.  
*Berne.*
- II. The same, rather more compact and ponderous.  
*Italy.*
- III. The same, of a yellowish white colour, still more compact and very ponderous.  
*Yorkshire.*
- IV. In a thick slab of a yellowish white colour and close earthy texture.  
*Mont Martre.*
- V. The same, of a light grey colour.  
*Same place.*

VARIETY II. INDURATED.

- VI. In an irregular piece of a yellowish colour, partly indurated and partly earthy and friable.  
*Stourbridge.*
- VII. In a flatted piece of a light brown colour, composed of aggregated spherules.  
*Alps.*
- VIII. Indurated and of a greyish colour, separated by fissures into irregular polyhedral columns, the surface being covered and fissures filled with yellow calcareous spar (Septarium).  
*Isle of Sheppey, Kent.*
- IX. An irregular detached portion of the same with stellated gypsum on the surface.  
*Same place.*
- X. Septarium in a large slab of a dark bluish grey colour, having its fissures filled with yellow calcareous spar.  
*Same place.*
- XI. In a long slab of an ash colour, very compact and indurated, with dark brown dendritic figures on the surface.  
*Cottam near Bristol.*

VARIETY III. SLATY.

- XII. Of a yellowish colour, indurated and of a slaty texture, with dendritic figures on the surface.  
*Pappenheim.*

SPECIES

SPECIES II. LIMESTONE with ARGILLITE.

Distinguishable from marble or common limestone, by being of a duller aspect and having an earthy smell when breathed on.

XIII. Of an earthy texture and dull white colour. *Piedmont.*

XIV. Of a brownish yellow colour, composed of layers and containing foliated manganese. *Obermoschel.*

SPECIES III. SILICEOUS LIMESTONE.

Of superior hardness to common limestone, giving fire occasionally with steel, and under the higher degrees of heat melting into an enamel.

XV. Of a compact texture, internally of a light brown colour, externally of a yellowish white.

XVI. Of an earthy texture and greyish white colour. *Purbeck.*

SPECIES IV. FERRUGINOUS LIMESTONE.

Limestone largely impregnated with oxyde of Iron, and thereby acquiring a red or yellow colour, and a disposition to become ochry on exposure to air.

XVII. Of a granular texture and reddish grey colour, ochry on the surface. *Somersetshire.*

SPECIES V. GYPSUM with CAECAREOUS SPAR.

Generally harder and more ponderous than common gypsum, and though but partially soluble, always effervescing with acids.

XVIII. Of a snow white colour and granular texture. *Zykfels.*

SPECIES VI. GYPSUM with SWINESTONE.

Easily distinguishable from common gypsum by its offensive odour on being scraped or powdered.

SPECIES

SPECIES VII. *GYPSUM with MARL.*

Generally of a greyish, brownish, bluish, or yellowish colour, of different degrees of induration, dull, of an earthy fracture and more or less effervescent.

GENUS II. *MAGNESIAN.*

SPECIES I. *CALCIFEROUS ASBESTINITE.*

Vide *Kirw. Elem. Mineral. Vol. I. P. 377.*

SPECIES II. *STEATITE with ARGILL.*

Harder and less unctuous than common steatite, and having an earthy smell when breathed on.

I. Of a dark olive green colour and slaty texture.

*Cornwall.*

SPECIES III. *SERPENTINE with HORNBLENDE.*

Usually of a blackish colour, and of a somewhat foliated or striated fracture.

II. Of a greenish black colour.

*Portfoy.*

SPECIES IV. *SILICIFEROUS POTSTONE.*

Considerably harder and rather lighter than the Potstone of *Como*. Vide *Kirw. Elem. Mineral. Vol. I. P. 376.*

SPECIES V. *FERRUGINOUS STEATITE.*

Generally of a bluish colour and of an increased specific gravity, becoming ochry by calcination or long exposure to air.

III. Of a reddish yellow colour.

*China.*

GENUS III. ARGILLACEOUS.

SPECIES I. CALCIFEROUS ARGILLITE.

Containing a larger proportion of Carbonate of Lime than common Argillite, and consequently effervescing more readily with acids.

- I. Of a light greenish grey colour and close texture.

SPECIES II. TALCOSE ARGILLITE.

Its colour whitish, bluish, or greenish grey; lustre considerable; softer than common argillite; specific gravity 2.717. Found in great abundance at *Holyhead*.

SPECIES III. SILICIFEROUS ARGILLITE.

Argillite intermixed with sand, jasper, or other forms of flint. Its colour generally grey of various tints; having some lustre, and slight transparency; hardness sometimes sufficient to give fire with steel; specific gravity from 2.61 to 2.67.

- II. Of a bluish black colour and slaty texture.

SPECIES IV. FERRUGINOUS ARGILLITE.

Argillite impregnated with oxyde of Iron, becoming thereby more ponderous and less slaty in its texture.

- III. Of a dark ash colour and slaty texture, ochry on the surface. *Jura, Orkneys.*

- IV. Of a yellowish red colour, slaty texture, and earthy fracture.

SPECIES V. HORNBLLENDE with GARNET.

Acquiring from the garnet more or less of a reddish colour, and a greater degree of lustre, hardness, and specific gravity.

SPECIES

SPECIES VI. *HORNBLENDE SLATE with TALC or MICA.*

Of a greenish grey colour, with some lustre, and often of sufficient hardness to give fire with steel; specific gravity about 2.815.

Found in great plenty in the *Isle of Anglesea*.

SPECIES VII. *HORNBLENDE SLATE with QUARTZ.*

Generally more or less of an ochre yellow colour, and of sufficient hardness to give fire with steel.

SPECIES VIII. *TRAP with HORNBLENDE.*

May be distinguished from common trap, by being for the most part of a greenish colour, and exhibiting glimmering particles.

SPECIES IX. *TRAP with MULLEN.*

SPECIES X. *TRAP with KRAG.*

Vide *Kirw. Elem. Mineral. Vol. I. P. 380.*

SPECIES XI. *SILICIFEROUS TRAP.*

Trap impregnated with different forms of flint, from which it acquires a closer texture and a greater degree of hardness.

SPECIES XII. *FERRUGINOUS CLAYS.*

*Colorific Earths.*

Clays receiving different shades of colour from the admixture of iron in various proportions, and in different degrees of oxydation. They stain the fingers, and generally change their colour on being exposed to heat.

V. Of

V. Of a blue colour, ochry on the surface, composed of serrated columnar concretions. *Colebrook Dale.*

VI. Of a yellowish colour, approaching to the nature of bole. *Saxony.*

VII. The same, of a lighter colour, more uniform in its texture, and of a harsher feel. *Mendip Hills.*

VIII. The same, of a still paler yellow colour. *Same place.*

IX. Of a verdigris green colour intermixed with red spots. *Verona.*

SPECIES XIII. *MULLEN with ASBESTINITE.*

Vide *Kirw. Elem. Mineral. Vol. I. P. 384.*

GENUS IV. *SILICEOUS.*

SPECIES I. *EARTHY QUARTZ.*

Quartz in mixture with a small portion of Alumine or Lime, having more or less of an earthy texture with but little lustre or transparency, often brittle, and sometimes very light.

I. Of a white colour and earthy texture, resembling burnt alum both in appearance and feel. *Mont Martre.*

SPECIES II. *FERRUGINOUS QUARTZ.*

Quartz receiving different shades of colour from admixture with Oxyde of Iron, by which its texture, transparency, hardness &c. are also often materially affected.

II. Of an ochre yellow colour. *Cornwall.*

SPECIES III. *EARTHY QUARTZ with ACTYNOLITE.*

Vide *Kirw. Mineral. Vol. I. P. 388.*

R

SPECIES

SPECIES IV. EARTHY HORNSTONE.

Containing a larger proportion of alumine than common hornstone, and exhibiting therefore a more earthy appearance.

SPECIES V. FERRUGINOUS HORNSTONE.

Generally of a reddish or yellowish colour, and for the most part more fusible than the common hornstone.

III. *a* 1. Of a reddish brown colour and conchoidal fracture. *Sweden.*

IV. *a* 2. Of a dull white colour, ochry on the surface, and penetrated with black dendritic figures. *Isle of Elba.*

SPECIES VI. SILICEOUS SCHISTUS with LIMESTONE.

Vide *Kirwan. Elem. Mineral. Vol. I. P. 392.*

SPECIES VII. SILICEOUS SCHISTUS with ARGILLITE.

Vide *Kirwan. Elem. Mineral. Vol. I. P. 391.*

SPECIES VIII. SILICEOUS SCHISTUS with MULLEN

Vide *Kirwan. Elem. Mineral. Vol. I. P. 391.*

SPECIES IX. PITCHSTONE with OPAL.

Vide *Kirwan. Elem. Min. Vol. I. 392.*

ORDER



ORDER III. AGGREGATED.

Earths or Stones of different kinds in a state of visible mixture.

GENUS I. CALCAREOUS.

SPECIES I. CALCAREOUS SANDSTONE.

Sand agglutinated by a calcareous cement. Generally of a whitish, greyish, or brownish colour with a rough surface and earthy fracture. It is sometimes found crystallised, and of sufficient hardness to give fire with steel; specific gravity from 2.5 to 2.6. When free from alumine it hardens on exposure to air. The most perfect crystals of this stone are found at *Fountainbleau*.

VARIETY I. CRYSTALLISED.

I. *a 1.* In large rhomboids of a dull white colour and rough surface variously mortified into each other. *Fontainbleau.*

*R. de L. Pl. 4. Fig. 45.*

VARIETY II. AMORPHOUS.

II. *a 1.* Composed of layers of a flesh red and dull white colour. *Norway.*

III. *a 2.* In a flatted piece of a brownish red colour, interspersed with silvery mica. Neighbourhood of *Mayence*.

The town of *Mayence* is built of this stone.

SPECIES II. CALCAREOUS BRECCIA.

Fragments of different kinds of Marble or of other stones imbedded in a calcareous cement.

IV. *a 1.* In a thin rounded slab composed of whitish marble in a dark coloured calcareous cement.

V. *a 2.* Fragments of reddish brown jasper in a calcareous cement.

GENUS II. *MAGNESIAN.*

SPECIES I. *POTSTONE-PORPHYRY.*

Felspar imbedded in a basis of Potstone, and generally of a greenish, reddish, or yellowish grey colour, with but little lustre or transparency; fracture foliated; specific gravity about 2.75.

VARIETY I. *AMORPHOUS.*

a. Undulatingly foliated.

SPECIES II. *SERPENTINE-PORPHYRY.*

Felspar imbedded in Serpentine; of various colours; without lustre; slightly transparent; easily scratched by the knife; specific gravity not exceeding 2.7.

VARIETY I. *AMORPHOUS.*

I. a 1. Composed of greenish white felspar, in dark green serpentine. *Florence.*

II. a 2: The same, having one surface polished. *Same place.*

GENUS III. *ARGILLACEOUS.*

SPECIES I. *ARGILLACEOUS SANDSTONE.*

Coarse sand, or minute fragments of Quartz, Flint, or Felspar, in an argillaceous cement, and often intermixed with Mica.

VARIETY I. *AMORPHOUS.*

a. Slaty.

I. b 1. Of a dull white colour and coarse sandy texture, having an earthy smell when breathed on.

SPECIES

## SPECIES II. RUBBLE STONE.

*Gres Gris*, Fr. *Grauwacke*, Germ.

Argillaceous cement with Quartz, Siliceous Schist or Hornstone, and Argillite. Its colour generally of different shades of grey; its texture slaty or compact; hardness various; specific gravity from 2.64 to 2.68.

## VARIETY I. AMORPHOUS.

- a. Slaty.
- b. Compact.

## SPECIES III. ARGILLACEOUS PORPHYRY.

Felspar contained in indurated Clay, Hornblende, Basalt or Argillite, having an earthy smell when breathed on, and seldom of sufficient hardness to give fire freely with steel.

## VARIETY I. AMORPHOUS.

- II. Composed of small crystals of felspar in a brown argillaceous cement. *Edinburgh.*
- III. Dark coloured felspar in a dark grey argillaceous cement.

## SPECIES IV. AMYGDALOID.

*Toadstone*.—*Mandelsheim*, Germ. *Variolite*.

Rounded masses of Calcedony, Agate, Zeolite, Calcareous Spar, Lithomarga, Steatite &c. in an argillaceous basis.

## VARIETY I. AMORPHOUS.

- IV. Rounded portions of calcareous spar in an argillaceous cement. *Derbyshire.*
- V. Portion of a large nodule, composed of white calcareous spar in a blackish brown argillaceous cement. *Same place.*
- VI. Portion of a nodule, composed of whitish steatite, in a brown argillaceous cement. *Wales.*

- VII. Nodules of pure white crystallised zeolite in blackish Basalt. *Giant's Causeway.*
- VIII. Numerous spherules of zeolite imbedded in a reddish brown argillaceous cement. *Germany.*
- IX. The same, in which the zeolite appears to have been decomposed. *Franckfort.*
- X. Twelve other varieties of Amygdaloid. *Scotland, Derbyshire, Tyrol, Oberstein, &c.*

#### SPECIES V. SCHISTOSE MICA.

An aggregate of Mica and Quartz, of a slaty texture, and splendid appearance; and often containing Garnets, Shorl, Actynolite, or Sappari.

##### VARIETY I. AMORPHOUS.

- XI. *a* 1. Reddish white quartz intermixed with silvery mica, and of a slaty texture.
- XII. *a* 2. White quartz with veins of brownish mica. *Cornwall.*
- XIII. *a* 3. Composed of blackish grey quartz and silvery mica. *Saxony.*
- XIV. *a* 4. ——— of white quartz and greenish mica. *Cordona, Levant.*
- XV. *a* 5. Eight slabs of schistose mica of various colours, from different places in the *Levant.*

#### GENUS IV. SILICEOUS.

##### SPECIES I. GRANITE.

Quartz, Felspar and Mica intermixed in different proportions. In its texture and colour, various; hardness always sufficient to give fire with steel; sometimes brittle; specific gravity usually from 2.56 to 2.76. Of all the mineral substances the most abundant, as it constitutes the basis of the highest and most extensive primitive mountains.

##### VARIETY

VARIETY I. AMORPHOUS.

I. a 1. Composed of large distinct portions of white quartz, reddish white felspar and brown mica. *Cornwall.*

II. a 2. ——— of brownish quartz, reddish white felspar and black mica. *Sweden.*

III. a 3. ——— of semitransparent quartz, dull white felspar and black mica.

*In a bog near Petersburg.*

On a pedestal of this granite stands the statue of *Peter the Great.*

IV. a 4. Composed of white quartz, white felspar, and silvery mica. *Bornborm.*

V. a 5. ——— of coarse grains of semitransparent quartz, brownish red felspar, and blackish brown mica. *Wales.*

VI. a 6. ——— of semitransparent quartz, dull white crystals of felspar and brown mica. *Cornwall.*

VII. a 7. ——— of semitransparent quartz, flesh red felspar and blackish mica.

*Egypt.*

VIII. a 8. ——— of semitransparent quartz, white mica, and decomposing white felspar. *Cornwall.*

IX. a 9. Eight polished specimens of Granite. *Calabria, Blankenbourg, &c.*

b. Slaty.

SPECIES II. SIENITE.

Quartz, Felspar and Hornblende with or without mica, aggregated in different proportions: supposed to be posterior in formation to Granite, and found to be fusible in a moderate heat.

VARIETY I. AMORPHOUS.

X. a 1. Composed of white quartz, pale flesh coloured felspar and black hornblende.

XI. a 2. ——— of white quartz, brownish white felspar and blackish hornblende.

*From a mountain near the Lake Sonico, Volcanonica.*

XII. a 3.

XII. *a* 3. The same, having a smaller proportion of Hornblende. *Same place.*

XIII. *a* 4. Composed of white quartz, brownish red felspar, and black hornblende.  
*Ile of Elba.*

*b.* Slaty.

### SPECIES III. GRANATINE.

Quartz, Felspar and Jade ; Quartz, Felspar and Schorl ; Garnet, Mica and Hornblende, &c.; aggregated into triple compounds. Vide *Kirw. Elem. Min. Vol. I. P. 342.*

#### VARIETY I. AMORPHOUS.

XIV. *a* 1. Composed of black schorl, red quartz, and silvery mica. *Scotland.*

XV. *a* 2. ——— of white quartz, silvery mica, and garnets.

XVI. *a* 3. ——— of white quartz, large fragments of black hornblende and silvery mica.

XVII. *a* 4. ——— of white quartz, black hornblende and black mica. *Norway.*

XVIII. *a* 5. ——— of white quartz, white silvery mica and garnets.

XIX. *a* 6. Three other varieties of Granatine.

### SPECIES IV. GRANITELL.

Quartz and Felspar ; Mica and Hornblende ; Jade and Garnet, &c. aggregated into binary compounds. Vide *Kirw. Elem. Min. Vol. I. P. 343.*

#### VARIETY I. AMORPHOUS.

XX. *a* 1. Composed of white quartz, and black hornblende.

XXI. *a* 2. The same, of a finer grain. *Val Sabia del Bresciano.*

XXII. *a* 3. In a polished slab of a still finer grain. *Bagolino in Val Sabia.*

XXIII. *a* 4. Composed of dull white quartz and black hornblende. (*Whin Stone.*)  
*Scotland.*

XXIV.

- XXIV. *a* 5. Eight other varieties of granitell; six of them cut and polished.  
*Scotland, Blanckenburg, and Italy.*
- XXV. *a* 6. Composed of white quartz and reddish white felspar. *Cornwall.*
- XXVI. *a* 7. ——— of white quartz and brownish red felspar.  
*Arthur's Seat, Scotland.*
- XXVII. *a* 8. Two varieties of granitell: *Wales and Germany.*
- XXVIII. *a* 9. Composed of brownish red felspar and black hornblende. *Leipzig.*
- XXIX. *a* 10. ——— of reddish white felspar and black hornblende. *Hartz.*

SPECIES V. GRANALITE.

Quartz, Felspar, Mica, Schorl, Garnet, Hornblende, &c. forming aggregated compounds of four or more ingredients.

VARIETY I. AMORPHOUS.

- XXX. *a* 1. Composed of white quartz, yellowish felspar, dark brown mica, and black hornblende. *Cornwall.*
- XXXI. *a* 2. ——— of white quartz, brownish white felspar, black mica, and black hornblende. *Monti sopra Edolo Valcamonica.*
- XXXII. *a* 3. ——— of white quartz, white silvery mica, large crystals of prismatic striated schorl, and garnets.
- XXXIII. *a* 4. ——— of white quartz, reddish felspar, green actynolite and black hornblende. *Hartz.*

SPECIES VI. GNEISS.

A mixture of Quartz, Felspar, and Mica, distinguishable from Granite by being always more or less of a slaty texture.

VARIETY I. AMORPHOUS.

- XXXIV. *a* 1. Composed of white quartz, reddish white felspar, and silvery mica, having a laminated texture. *Scotland.*
- XXXV. *a* 2. ——— of a white quartz, reddish felspar, and brownish mica. *Saxony.*
- b.* Fibrous.

S

SPECIES

## SPECIES VII. SILICEOUS PORPHYRY.

Crystals of Felspar imbedded in Jasper, Hornstone, Pitchstone, Obsidian, Siliceous Schistus, Schistose Hornstone or Amorphous Felspar; of a compact or slaty texture, and so hard as to give fire with steel. Often found, like the foregoing, to constitute entire mountains.

## VARIETY I. AMORPHOUS.

XXXVI. *a* 1. Composed of elliptical crystals of felspar, of a yellowish white colour, imbedded in purplish coarse jasper.

XXXVII. *a* 2. ——— of numerous small crystals of felspar of a yellowish white colour, in a brownish black siliceous cement. *Sweden.*

XXXVIII. *a* 3. A large nodule of the same. *Same place.*

XXXIX. *a* 4. In a thin slab composed of crystals of reddish white felspar in a brown siliceous cement.

XL. *a* 5. Composed of numerous small crystals of greenish white felspar in black jasper. (*Antique Porphyry.*) *Egypt.*

XLI. *a* 6. The same, with small fragments of felspar. *Pizzo, Calabria.*

XLII. *a* 7. Composed of white felspar, in a greenish siliceous cement approaching to the nature of serpentine. *Egypt.*

XLIII. *a* 8. ——— of dull white felspar, in brownish red hornstone. (*Common Porphyry.*) *Germany.*

XLIV. *a* 9. ——— of numerous small crystals of reddish white felspar, in brownish red hornstone. *Egypt.*

XLV. *a* 10. A thin polished slab, composed of crystals of yellowish white felspar in red jasper.

XLV\*. *a* 11. Nine other varieties of porphyry, cut and polished.

*Dresden, Blankenburg, &c.*

*b.* Slaty.

## SPECIES



SPECIES VIII. PUDDING-STONE.

Rounded pebbles of Quartz or Flint imbedded in a filiceous cement;

VARIETY I. AMORPHOUS.

XLVI. *a* 1. Rounded pebbles of quartz and flint of different sizes, agglutinated by a filiceous cement. *Hertfordshire.*

XLVII. *a* 2. Sixteen other varieties of pudding-stone cut and polished.

SPECIES IX. SILICEOUS SANDSTONE.

Sand or filiceous particles in a state of cohesion more or less perfect.

VARIETY I. AMORPHOUS.

XLVIII. *a* 1. Of a dull white colour and fine granular texture. *Windfor.*

XLIX. *a* 2. Of a brownish red colour, and composed of thin parallel layers. *Frankfort.*

L. *a* 3. Composed of white and brown parallel veins. *Mayence.*

LI. *a* 4. Of an ochry white colour, enclosing crystals of cubic pyrites. *Bengal.*

SPECIES X. SILICEOUS BRECCIA.

Angular fragments of siliceous stones in a filiceous cement.

VARIETY I. AMORPHOUS.

LII. *a* 1. Angular fragments of white quartz, in brownish red jasper. *Aberdeenshire.*

LIII. *a* 2. Three other varieties of Siliceous Breccia.

## CLASS III. METALS.

THE characteristic properties of these when pure, or unalloyed, are their opacity, splendour, and power of conducting the electric fluid. Their colour is different shades of white, grey, red or yellow; texture spicular or hackly, granular, granularly foliated or striated; hardness from that which yields to the nail, as lead, to that which gives fire with steel; specific gravity from 6.343 to 23.000.

Some metals are malleable and ductile to a great extent, as platina, gold, silver, &c. others fragile, as bismuth, nickel, arsenic, &c.; hence their division into *Metals* and *Semi-Metals*.

On exposure to the combined action of air and moisture, some remain unchanged; others, by uniting with carbonic acid or with oxygen, lose their splendour and tenacity, and are converted into a state of rust.

They are also very differently affected by exposure to heat. In close vessels they simply melt, and may in some instances be volatilised; but if air be admitted, whilst some resist its influence, as platina, gold, and silver, others are converted into oxyds susceptible of subsequent vitrification, and of communicating a tinge to glass; the former metals therefore called *perfect*, the latter *imperfect*. Tin, the most fusible of the metallic bodies, melts at 410 *Farenh.* Platina, and some others, require for their fusion the application of the most intense degrees of heat. When melted, the metals assume a convex surface, and exhibit a disposition to crystallize in cooling. By fusion they may, with a few exceptions, be combined with each other in all proportions, undergoing thereby remarkable changes of volatility, fusibility, and weight. Most of them may also in this way be united with sulphur, many with phosphorus, and some with charcoal.

All the metals are soluble either in the nitric or oxy-muriatic acid, and precipitable from their solutions in these acids, not only by the alkalies and most of the earths, and often by each other, but likewise by prussiate of pot-ash in every instance, the solution of platina excepted. They are all in the moist way, except zinc, soluble also in alkaline sulphurets.

The principal states in which these bodies are presented to us in the mineral kingdom are, either *native*, that is when in possession of the foregoing properties, or where they

they lose these properties by combination with oxygen, with certain of the acids, sulphur, oxyde of arsenic, &c. and are then said to be *mineralised*.

The metallic bodies are generally found in veins, clefts, or fissures, running more or less obliquely in the strata of primitive or secondary mountains, and are for the most part accompanied by quartz, calcareous spar, or other heterogeneous matter, which serves them as a matrix, and from which they are separated in the mechanical operations of pounding, sifting, washing, &c.

The list of the metallic bodies is, Platina, Gold, Quicksilver, Silver, Lead, Copper, Iron, Tin, Bismuth, Nickel, Arsenic, Cobalt, Zinc, Antimony, Manganese; to which may be added Scheele, Uranite, Molybdena, Menachanite, and as still later discoveries, Silvanite and Titanite.

## ORDER I. DUCTILE.

### GENUS I. PLATINA.

*Platine, Or blanc, Fr.*

When pure, this is of a white colour, intermediate between that of tin and silver, and is the heaviest body in nature, its specific gravity being upwards of 22. It is malleable and ductile to a great extent, though harder than either gold or silver. It undergoes no change by exposure to the air. In the common fire it cannot be fused, but may be softened to such a degree as to become capable of being wielded. To the oxy-muriatic acid or aqua regia, in which alone it is soluble, it communicates at first a yellow and afterwards a reddish brown colour, and from these it may be precipitated by muriate of ammoniac, but neither by prussiate of potash nor solution of sulphate of iron, properties which distinguish it from gold. It is said to be also soluble in sulphuret of potash. It is scarcely affected in the dry way either by compound salts or by sulphur, but may be united by fusion with arsenic; and in different proportions with several of the other metals, but most easily and intimately with zinc. With copper it produces a compound of a golden colour, hard, malleable, close grained, susceptible of a fine polish, and durable. It amalgamates readily with mercury.

This metal was first brought into Europe from the Spanish settlements in *South America* in the year 1741, and has hitherto been found only in a metallic state, in small flattened grains of a grey silver white colour, intermixed with ferruginous sand and particles of native gold and of quicksilver, being collected in the washings of the arenaceous gold ores, and principally those of *Novita* and *Citaria*, north of *Choco* in *Peru*. It is also said to have been met with in the island of *Barbadoes*.

### SPECIES

## SPECIES I. NATIVE PLATINA.

## VARIETY I. IN GRAINS.

I. a 1. Native platina in small flatted angular grains of a dark tin white colour.

*Bogodo, Santa Fé.*

Platina in this state is found to contain from one third to one fourth its weight of iron, by which it is rendered magnetic, and reduced nearly one half in its specific gravity. To purify it most effectually, it must either be dissolved in oxy-muriatic acid and precipitated by muriate of ammoniac, or fluxed with a mixture of oxyde of arsenic and potash, heated afterwards with oil, and then digested in the nitric acid. Vide *Kirw. Elem. Min. Vol. II. P. 104.*

## GENUS II. GOLD.

The most valuable of the metallic bodies, when pure, is of a bright yellow colour and very splendid. Next to platina it is the heaviest body in nature, being to water as 19.300 to 1.000, and by far the most malleable, as well as the most ductile substance we are acquainted with. It is harder and more elastic than lead or tin, but less so than platina, silver, copper, or iron; not sonorous. It suffers no change either on exposure to air or moisture. It melts at 32 of *Wedgw.* = 5237 *Farenheit*, exhibiting a beautiful bluish green, or aqua marine colour; but is incapable of being volatilised or oxydated, unless under the application of the most intense degrees of heat. Upon being allowed to cool slowly it crystallizes into four-sided pyramids.

The only acids capable of acting on it are the oxy-muriatic acid and aqua regia, with which it forms a yellowish solution, remarkable for the properties of staining the skin purple. From these, as in other instances of metallic solutions, the gold may be precipitated by the alkalies and soluble earths. It may also be thrown down by zinc, bismuth, quicksilver, tin, and many other metals, and in its metallic state by æther, different essential oils, phosphorus, and solution of sulphate of iron. It is likewise soluble in solutions of alkaline sulphuret. The precipitate by tin is of a purple colour (*Purple powder of Cassius*) that by ammoniac (*Aurum fulminans*) explodes with great violence on exposure to gentle heat.

Gold in its metallic state readily and intimately combines by fusion with all the other metals. With silver it becomes paler; with copper of a deeper colour, more fusible, harder and more elastic. Its oxyde communicates a red colour to glass. The ores of gold are,

SPECIES

## SPECIES I. NATIVE GOLD.

Or *Native*, Fr. *Gediegen Gold*, Germ.

In this state gold is never met with perfectly pure, being always alloyed with silver, copper, or iron, more especially the two former. The proportion of alloy has in several instances been found to be nearly the same with that of our common gold coin, viz. about 22 carats. Native gold varies much in its colour, which is sometimes of a bright yellow, often as pale as brass, and sometimes tarnished of a reddish brown. It varies also considerably in its forms, being either found crystallised or in detached amorphous masses ramifying or interspersed through other substances, or applied to them superficially, or in loose grains. When crystallised, its form is generally the aluminaform octohedron with its modifications.

In collecting it from those substances through which it is disseminated, or with which it may be accidentally in mixture, advantage is taken of its disposition to amalgamate with quicksilver, and to free it from alloy requires cupellation with lead or some other process of refinement. The richest mines of native gold are those of *Hungary*, *Siberia*, the *Brazils*, *Chili*, *Peru* and *Mexico*.

## VARIETY I. CRYSTALLISED.

I. *a* 1. Pure regulus of gold superficially crystallised.

II. *a* 2. Native gold tarnished on the surface, ramifying on ochry quartz, in many places crystallised in very small and regular octohedrons. *Nagyag, Transylvania.*

*R. de S. Jlle, Pl. 3. Fig. 1.*

III. *a* 3. In very small octohedral crystals of a brass yellow colour, on grey quartz. *Cremnitz.*

IV. *a* 4. Partly in very small octohedral crystals, and partly dendritiform, and of a pale yellow gold colour, on crystallised quartz. *Same place.*

V. *a* 5. In very small octohedral crystals of a brass yellow colour, intermixed with black silver ore also minutely crystallised, on milk-white spongy quartz. *Hungary.*

VI. *a* 6. In very regular small octohedral crystals, implanted on laminated native gold of a brass yellow colour, on impure grey quartz. *Nagyag.*

VII. *b* 1. In small aggregated tetrahedral prisms with tetrahedral pyramids, of a brass colour.

colour and very splendid, producing a lace-like appearance on greyish argillaceous quartz. *Transylvania.*

*Catal. de Raab. xvi. A. b. 3.*

VIII. *c* 1. In small cubic crystals, imbedded in laminated native gold, without matrix. *Verepatak, Transylvania.*

*d.* Indeterminate.

By *R de l'Isle*, the pyramidal crystallization so often observable on the surface of laminated native gold, is considered as depending on the projection of the solid angles of small cubes of which these lamellæ are composed.

## VARIETY II. OF PARTICULAR SHAPES.

IX. *a* 1. Of a bright yellow colour, dendritiform or moss-like, with minutely crystallized semitransparent quartz and galena, on an argillaceous breccia interspersed with yellow pyrites. *Abrudbanya, Transylvania.*

X. *b* 1. Of a deep yellow colour, thickly ramifying on fat milk white quartz. *Peru.*

*c* 1. Filiform.

XI. *d* 1. In laminae partly of a deep gold yellow, and partly of a pearly grey colour, in white calcareous spar with a small vein of quartz underneath.

*Kongsberg, Norway.*

The pearly appearance in this specimen is probably owing to the gold being combined with a greater than usual proportion of silver.

XII. *d* 2. The same, of a gold yellow colour, in fat quartz, with grey ore of antimony. *Hungary.*

XIII. *d* 3. The same, in variegated copper ore.

*Norway.*

XIV. *d* 4. The same, of a brown colour and without lustre, with cubic vitreous silver ore and crystallized quartz, on ash-coloured indurated clay. *Chemnitz, Hungary.*

## VARIETY III. AMORPHOUS.

XV. *a* 1. In a large irregular mass of a pure gold colour, in which are imbedded small fragments of semitransparent white quartz. *Peru.*

XVI.

- XVI. *b* 1. In loose irregular grains. *Tibet.*
- XVII. *b* 2. In smaller grains intermixed with grains of stream tin ore. *Cornwall.*
- XVIII. *c* 1. Intersperfed through native cinnabar in grey opake quartz. *Hungary.*
- XIX. *c* 2. Intersperfed through pale brafs yellow iron pyrites in femitransparent fat quartz. *Adelfors, Sweden.*
- XX. *c* 3. The fame, in yellowish grey opake quartz. *Nagyag, Tranfylvania.*
- XXI. *c* 4. Intermixed with brilliant yellow pyrites and intersperfed through grey opake quartz. *Same place.*
- XXII. *c* 5. Intersperfed through decomposing ochry pyrites. *Catbarinaberg, Siberia.*
- XXIII. *c* 6. In decomposing iron pyrites of a liver colour. *Banat.*
- XXIV. *c* 7. In brownish red finopel and yellow fealy blende. *Schemnitz.*
- XXV. *c* 8. In dull yellowish clay. *Biber in Hefse.*
- XXVI. *c* 9. With yellow tetrahedral blende intermixed with quartz and covered with cellular decomposed felspar. *Schemnitz.*
- XXVII. *c* 10. In grey antimonial ore. *Bareuth.*
- XXVIII. *c* 11. In native realgar with minutely cryftallifed quartz on bluish grey indurated clay. *Tranfylvania.*
- XXIX. *c* 12. In leaden grey granulated galena in milk white opake quartz. *Bareuth.*
- XXX. *c* 13. In grey filver ore, with cinnabar and white opake quartz. *Hungary.*
- XXXI. *c* 14. In reddish brown phosphorefcient blende, with transparent laminated gypfum. *Konftock, Bohemia.*

## SPECIES II. GREY GOLD ORE.

Or *gris*, Fr. *Nagyager Golderz*, Germ.

It occurs either in small tetrahedral crystals, or more commonly in hexagonal or indeterminate lamellæ, or in grains interspersed through rose red pearl spar, and often accompanied with quartz, grey copper ore, and auriferous pyrites. The lamellæ are of different degrees of thickness, and are attached to and intersect each other in various directions. The colour of this ore is blackish leaden grey, with considerable lustre. Its fracture foliated, the folia being somewhat flexible and opaque. It may be easily scraped with the knife, and stains the fingers like plumbago. Specific gravity 8.919. Under the blow-pipe it yields sulphur, and oxyde of antimony and of arsenic, leaving on the charcoal a globule of gold and silver, together with some oxyde of lead and of iron. When reduced to powder, three parts in a hundred are found to be attracted by the magnet, and twenty-one soluble in the nitric acid.

The richest specimens of this ore have been computed to contain 25 per cent. of gold in combination with silver. By the analysis of *Ruprecht*, it consists of Sulphur 41.66, Oxyde of Lead 25.00, Oxyde of Iron 16.66, Gold 11.66, Silver 2.33, Oxyde of Arsenic 1.00, Oxyde of Antimony 2.08. It has hitherto been found only at *Nagyag* near *Deva* in *Transylvania*.

## VARIETY I. CRYSTALLISED.

XXXII. *a* 1. In aggregated tetrahedral crystals, with minutely crystallised flesh red pearl spar on metalliferous rock. *Nagyag.*

XXXIII. *a* 2. In aggregated cubes variously truncated, with transparent crystallised quartz and pale flesh red pearl spar and brown blende. *Same place.*

XXXIV. *b* 1. In large shining hexagonal laminæ, in a mixture of quartz and reddish white pearl spar. *Same place.*

XXXV. *b* 2. In smaller laminæ, in a mixture of yellow pearl spar and brown blende. *Same place.*

XXXVI. *c* 1. Interspersed through reddish white pearl spar. *Same place.*

## VARIETY II. OF PARTICULAR SHAPES.

XXXVII. *a* 1. Intermixed with brown scaly blende, and exhibiting a dendritic appearance, in rose red pearl spar. *Same place.*



## SPECIES III. WHITE GOLD ORE.

*Aurum Graphicum.* Or blanc, Fr. *Weisses Golderz*, Germ.

This occurs most commonly either interspersed, or in small indeterminate or tabular crystals of a greyish white colour, intermediate between that of regulus of antimony and bismuth. Its crystals are generally attached to each other laterally, and distributed superficially on their matrix (a mixture of lithomarga and quartz interspersed with pyrites) so as somewhat to resemble print, hence called *Aurum graphicum*. It is of considerable splendour; its texture in one direction foliated, in others finely granular; its fragments irregularly angular and uneven. It yields readily to the knife; foils the fingers; specific gravity 5.723. It decrepitates, and fuses easily under the blow-pipe, and by a continuance of the heat a considerable part flies off in the form of an inodorous whitish smoke, leaving behind a pale gold globule. According to *Muller*, this ore consists of Gold in union with a new Semimetal, together with a small proportion of Arsenic and of Nickel.

It has hitherto been found only at *Facebay* and at *Offenbanya* in *Transylvania*.

## VARIETY I. OF PARTICULAR SHAPES.

XXXVIII. *a* 1. Of a tin white colour inclining to steel grey, crystallised in small striated aggregated prisms, on minutely crystallised semitransparent quartz, covering metalliferous rock.  
*Offenbanya, Transylvania.*

XXXIX. *a* 2. The same, on coarse red jasper intermixed with white quartz.  
Said to come from *Spain*, but more probably from *Transylvania*.

## VARIETY II. AMORPHOUS.

## GENUS III. QUICKSILVER.

*Argentum Vivum, Hydragyrus.* Mercure, Fr. *Quecksilber*, Germ.

Pure quicksilver is of a silver or tin-white colour, and of a liquid form at all temperatures between 600° above, and 40° below 0 of *Farenh*. Its specific gravity 13.56. It is not perceptibly altered either by the simple application of heat, or by exposure to the air; but by agitation in this fluid it may be converted into a black, and by the assistance of heat into a red oxyde, from which by an increase of the heat alone, it may be brought back to its metallic state.

The nitric and oxy-muriatic are the only acids which are acted on by this metal without the assistance of heat; but, when reduced to an oxyd, it combines with the sulphuric, muriatic, acetic, and most of the other acids without difficulty. From its solutions in these it may be precipitated by copper, iron, and zinc; and if thrown down by an alkali, the precipitate when mixed with sulphur, upon being gradually heated, possesses the power of exploding. Quicksilver combines readily with pure platina, gold, silver, and most of the other metals, forming what are called amalgams. By trituration or fusion, it may be united with sulphur into a dark compound, known by the name of *Æthiops*, which in close vessels sublimes into a red striated mass called *artificial Cinnabar*. It may be converted also into an *Æthiops* by trituration with the solutions of sulphure of potash or of soda, and into *faëtitious Cinnabar* with a solution of sulphuret of ammonia. Besides the application of the various preparations of quicksilver in the practice of medicine, it is employed in the working of gold ores, as before mentioned, in the construction of philosophical instruments, and of mirrors, as also in gilding and painting. The ores of this metal are,

#### SPECIES I. NATIVE QUICKSILVER.

This is generally met with in small brilliant globules disseminated through stones, clays, and various mercurial ores, or collected in more considerable quantity in the clefts and hollows of rocks. It differs from distilled quicksilver only with regard to its degree of purity. It is found in the greatest abundance in *Idria*, *Deux Ponts*, and other parts of *Germany*, and at *Almaden* in *Spain*.

#### VARIETY I. FLUID.

I. a 1. Fluid quicksilver.

*Hungary.*

#### VARIETY II. INTESPERSED.

II. a 1. Native quicksilver in small globules, on ponderous coarse grained dark cinnabar without matrix.

*Almaden.*

III. a 2. The same, with ferruginous cinnabar, on grey emery.

*Palatinate.*

IV. a 3. The same, disseminated through coarse grained ferruginous cinnabar with yellow iron pyrites.

*Wolffstein.*

V. a 4. The same, in irregular globules disseminated through coarse ferruginous cinnabar.

*Stahlberg.*

VI. a 5.

VI. *a* 5. The same, disseminated through bluish-black argillaceous schistus. *Idria*.

## SPECIES II. NATIVE AMALGAM.

This, which is of a silver or tin-white colour and metallic splendour, is found most commonly either interspersed through, or lying on the surface of other quicksilver ores containing silver. It sometimes also occurs in small lumps, and sometimes in aluminiform octohedral crystals truncated at their solid angles and borders. In its hardness, brittleness, and weight, it differs according to the proportion of its constituent parts. In general it is found to yield from 80 to 90 per cent. of quicksilver, and from 10 to 20 of silver, which are easily separable from each other by the simple application of heat. It has principally been met with in the mines of *Deux Ponts* and *Upper Hungary*.

### VARIETY I. CRYSTALLISED.

*a*. In truncated octohedrons.

VII. *b* 1. Native amalgam, in amorphous ponderous spar. *Obermoßbel.*

VIII. *b* 2. The same, in bluish indurated clay intermixed with cinnabar and pyrites. *Idria.*

IX. *b* 3. The same, on grey indurated clay mixed with cinnabar. *Moschellandsberg, Deux Ponts.*

X. *b* 4. The same, minutely disseminated through grey clay. *Idria.*

## SPECIES III. NATIVE OXYDE.

*Queckfilber Lebererz, Germ.*

This occurs in opaque lumps of a dark grey, or dark cochineal-red colour. Its texture either fine grained, compact or flaty. Its internal lustre generally approaches to the metallic. Its fragments are angular. Specific gravity from 7.186 to 9.230. It may be easily scraped with the knife, and gives a dark red streak. It is not acted on by the nitric acid, but dissolves in the muriatic by the assistance of heat. It yields from 20 to nearly 80 per cent. of quicksilver. It is often intermixed with native Quicksilver, Cinnabar, and Oxyde of Iron, and has by some been thought to be little else than cinnabar intimately combined with bituminous slate. It is the most common of all the quicksilver ores of *Idria*. The *Coralline ore*, as it is called, is one of its most remarkable varieties.

### VARIETY

## VARIETY I. AMORPHOUS.

XI. *a* 1. Of a brownish red colour, and granular texture, internally of a glimmering lustre. *Idria.*

XII. *a* 2. The same, somewhat more splendid, and covered with black shining indurated bitumen. *Kirckheim, Pohlen.*

XIII. *b* 1. Of a greyish liver brown colour, very compact and ponderous. *Idria.*

XIV. *c* 1. Of a conchoidal texture, and dark cochineal red colour (*Coralline ore*). *Same place.*

XV. *c* 2. Of a flaty texture, and shining dark reddish brown colour. *Same place.*

XVI. *c* 3. The same, less ponderous, and of a dark grey colour. *Same place.*

These ores all yield a small proportion of quicksilver under the simple application of heat in close vessels; but are found by experiment to contain also a considerable proportion of cinnabar.

## SPECIES IV. HORN QUICKSILVER.

Is met with either in small crystals, or forming an incrustation on the exterior surface or in the cavities of coarse ferruginous cinnabar ores, and is generally accompanied with native mercury. It is of a whitish, greyish, greenish, or blackish colour, with more or less transparency and splendour. The figure of its crystals, the tetrahedral rhomboidal prism with tetrahedral pyramids. Under exposure to heat it sublimes without decomposition, and according to the experiments of Mr. *Woulfe*, by whom this ore was first analysed, it consists of oxyde of mercury in union with the muriatic acid, and a still larger proportion of the sulphuric. *Monf. Sage* states it to yield 86 per cent. of quicksilver. It is found at *Moschellandsberg* in the Dutchy of *Deux Ponts*, and also, as it is said, in *Heffe*.

## VARIETY I. CRYSTALLISED.

XVII. *a* 1. In olive coloured tetrahedral prisms terminated by tetrahedral pyramids, the faces of which are triangular, with native quicksilver and ferruginous cinnabar, on grey quartz. *Obermoschel.*

*N. B.* The

*N. B.* The crystallisation of this differs from that given by *Romé de L'Isle*, *Pl. 7. Fig. 31*, in which the faces of the pyramid are rhomboidal.

XVIII. *a 2.* Forming a semitransparent incrustation of minute crystals of a grey colour on coarse hematitical cinnabar, with indurated clay. *Same place.*

*b.* Indeterminate.

## SPECIES V. CINNABAR.

This is by far the most common of the ores of quicksilver. It occurs either crystallised, or in irregular veins or lumps intermixed with, or interspersed through, other mineral substances, or forming an efflorescence on their surface. Its colour is most commonly cochineal-red or scarlet, sometimes reddish brown, or even greyish black. Its texture in the mass is either fibrous, granular, scaly, or compact. It is in most instances so soft as readily to stain the fingers, is very brittle, and, when rubbed to powder, or scratched with the knife, it loses its splendour and becomes of a lighter colour. When crystallised it has always more or less transparency and lustre, and assumes the form of double tetrahedral pyramids truncated at their summits, with or without intermediate prisms. It varies in its specific gravity, from 5.419 to 10.1285. Before the blow-pipe it is volatilised, emitting a bluish flame and sulphureous odour.

The purest cinnabar ores are found to contain about 80 parts of quicksilver, and 20 of sulphur; which in the moist way are most easily separated by the oxy-muriatic acid, and in the dry by distillation with admixture of lime or filings of iron.

The principal European mines of cinnabar are those of *Idria* in *Carniola*, *Carinthia*, *Frioul*, the *Palatinate*, *Deux Ponts*, *Transylvania*, *Hungary*, and more especially of *Almaden* in *Spain*. It is also found in considerable quantities in different parts of *South America*, *Japan*, and *China*.

## VARIETY I. CRYSTALLISED.

XIX. *a 1.* In large tetrahedral crystals having the apices deeply truncated parallel to their base; of a bright red colour and semitransparent;—on black ferruginous sand stone. *Almaden.*

XX. *a 2.* In small brilliant crystals confusedly aggregated, many of them of the same figure with the former, with native quicksilver in small globules and compact cinnabar, on yellowish indurated clay. *Obermoschel.*

XXI. *a 3.* In minute crystals confusedly aggregated, with globules of native quicksilver, in ash-coloured indurated clay intermixed with white quartz. *Morsfeldt.*

XXII. *a 4.*

XXII. *a* 4. The same, in blackish indurated clay.

*Idria.*

*b.* Indeterminate.

## VARIETY II. AMORPHOUS.

XXIII. *a* 1. Of a bright red colour, semitransparent and of a scaly texture, in fat white quartz intermixed with yellow pyrites.

*Almaden.*

XXIV. *a* 2. Of a shining brownish black colour and scaly texture.

*Hungary.*

*b.* Fibrous.

XXV. *c* 1. Of a bright red colour and granular texture, with yellow pyrites and white quartz.

*Same place.*

XXVI. *c* 2. Of a bright red colour, in white quartz artificially polished.

*Almaden.*

XXVII. *c* 3. Of a brownish red colour, stalactitical on the surface.

*Obermoßbel.*

XXVIII. *c* 4. Of a lighter colour, intermixed with white clay.

*Transylvania.*

XXIX. *c* 5. Composed of large irregular grains of a reddish colour, with white baro-felenite.

*Hungary.*

XXX. *d* 1. In detached compact pieces of a bright red colour.

*East Indies.*

XXXI. *d* 2. The same, in smaller pieces.

*Same place.*

XXXII. *d* 3. In small pieces of a paler colour, with white quartz and native sulphur.

*Hungary.*

*e.* Earthy.

XXXIII. *f* 1. In a powdery form, and of a bright scarlet colour (*native Vermilion*): in cellular ferruginous clay.

*Wolfstein.*

XXXIV. *f* 2. In a sandy form, intermixed with white quartz and yellow pyrites.

*Hungary.*

XXXV. *f* 3. Pulverulent, and of a reddish colour, interspersed through indurated clay, with minutely crystallised azure copper ore.

*Obermoßbel.*

XXXVI. *f* 4.

XXXVI. *f* 4. The same, intermixed with ochry indurated clay and crystallised baroselenite. *Stahlberg.*

#### SPECIES VI. HEPATIC ORE.

*Cinabre Alkalin*, Fr. *Quecksilber-Schwefellebererz*, Germ.

This is described by *Baron Bern*, as of a bright red colour, transparent, and of a sparry texture; breaking into rhomboidal fragments, and upon being scratched or powdered, exhaling an hepatic odour. It was discovered not many years since in the mines of *Idria*, and is supposed to consist of Oxyde of Quicksilver in union with Sulphuret of Alkali or of Lime; it differs therefore considerably from the *Lebererz* of the Germans, SPECIES III. Vide *Catal. de Raab*. T. 11. P. 394.

#### VARIETY I. AMORPHOUS.

*a.* Foliated.

#### GENUS IV. SILVER.

*Argentum*. *Argent*, Fr. *Silber*, Germ.

Silver unalloyed is of a pure or, as it is called, silver white colour; susceptible of a high polish and very splendid, but tarnishing on exposure to air. Next to platina and gold, it is the most ductile as well as the most tenacious of the metallic bodies. A wire of  $\frac{1}{8}$  of an inch in diameter supports a weight of 270 pounds. It is more elastic, and therefore more sonorous than gold, tin, or lead. Its specific gravity 10.474, when hammered 10.510. It melts at 28 of *Wedgw.* = 4717 *Farenh.* By the higher degrees of heat it may be volatilised and oxydated, so as to become capable of communicating a yellow colour to glass. It dissolves in the nitric acid with great facility, and also without difficulty in the nitro-sulphuric acid or aqua regina of *Keir*; from both which it may be precipitated in its metallic state by zinc, iron, copper, and quicksilver. The effects of phosphorus on its solutions are likewise similar to those which take place on the application of this substance to the solution of gold. When precipitated from the nitric acid by lime water, the precipitate, when dried and afterwards washed with a solution of pure ammoniac, explodes upon the slightest friction with uncommon violence, hence called *Argentum fulminans*. Silver may be united by fusion with all the other metals; if alloyed by copper it becomes harder and more sonorous. It combines readily with sulphur, and upon exposure to hepatic gas is immediately blackened. The uses of silver are equally various and important with those of gold. The ores of silver are,

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SPECIES

## SPECIES I. NATIVE SILVER.

*Argent natif*, Fr. *Gediegen Silber*, Germ.

This, like gold, is never found free from alloy, being always combined with a certain proportion of copper, and sometimes with a small quantity of gold, iron, or regulus of antimony. Like gold too it differs in its colour and degrees of lustre, and is equally various in its forms. Though sometimes free from tarnish, it is generally of a golden yellow, brownish, or even black colour. It is frequently met with in the mass; frequently also interspersed through, or attached to various other mineral substances; or in the form of knobs; or in plates or branches, which are often composed of small accumulated crystals; or in the form of wire or hair. The figure of its crystals is either octohedral or cubical, generally the former. It differs little from pure silver in its weight, texture, hardness, ductility, fusibility, &c. From its alloy with copper, iron, and antimony, it may be easily refined by cupellation with the necessary quantity of lead. Amongst the principal mines of native silver are those of *Kongsberg* in *Norway*, *Freyberg* in *Saxony*, *Katbarinenberg* in *Siberia*, *Joachimsthal* in *Bohemia*, and more especially of *Potosi* in *Peru*.

## VARIETY I. CRYSTALLISED.

I. Pure regulus of silver superficially crystallised.

II. *a* 1. In aggregated cubes of a silver white colour, in white calcareous spar and transparent crystallised quartz. The faces of the cubes in this specimen measure from  $\frac{1}{4}$  to  $\frac{1}{2}$  of an inch. *Kongsberg, Norway.*

III. *b* 1. In superficial tetrahedral pyramids of the same colour with the former, some very regular, and variously interspersed with minute needleform stellated calcareous spar, on decomposing grey silver ore intermixed with yellow baroselenite and quartz.

*St. Marie aux Mines.*

IV. *c* 1. In penniform crystals, the quadrangular branches of which are terminated by tetrahedral pyramids. *Potosi.*

## VARIETY II. OF PARTICULAR SHAPES.

V. *a* 1. Dendritic, and of a yellowish silver white colour, in pearl-grey baroselenite. *Freyberg.*

VI. *a* 2. In larger ramifications in flesh coloured baroselenite.

*Same place.*

VII. *a* 3.



VII. *a* 3. The same, with red oxyde of cobalt, in white calcareous spar on grey hornstone. *Norway.*

VIII. *a* 4. Forming a vein in gneifs. *Marienberg.*

IX. *a* 5. Of a bronze yellow colour, producing a netted appearance in grey hornstone. *Annaberg.*

X. *a* 6. Having externally an ochry appearance. *Catharinenberg, Siberia.*

XI. *a* 7. Forming a vein in ochry quartz with horn silver ore on the surface. *Jobngeorgenstadt.*

XII. *b* 1. Ramose and somewhat tarnished, the branches variously contorted, and covered partly by vitreous silver ore, and partly by minutely crystallised ash-grey baroselenite. Attached to its branches are several crystals of galena and brown blende.

*Freyberg.*

XIII. *b* 2. The same, in long branches shooting from calcareous spar. *Norway.*

XIV. *b* 3. In contorted branches projecting from vitreous silver ore. *Norway.*

XV. *b* 4. Ramifying in indurated bitumen with calcareous spar.

XVI. *b* 5. In short irregular branches, in black blende intermixed with rhombic calcareous spar. *Same place.*

XVII. *b* 6. Branching through the substance of transparent crystallised quartz, with vitreous silver ore and pyrites. *Norway.*

XVIII. *c* 1. Filiform, of a silver white colour, and without matrix. *Norway.*

XIX. *c* 2. Of the same form, with an ochry covering on grey ochry quartz. *Freyberg.*

XX. *d* 1. Capillary, and of a silver white colour, in brown quartz minutely crystallised on the surface. *Jobngeorgenstadt.*

XXI. *d* 2. The same, on grey decomposing cobalt ore with quartz. *Schneeberg.*

XXII. *d* 3. With black silver ore and arseniate of cobalt, on grey quartz intermixed with grey cobalt ore. *Same place.*

XXIII. *d* 4. Somewhat tarnished, on pale greenish indurated clay.

*Alemont, Dauphiné.*

XXIV. *d* 5. With black silver ore intermixed with cubic fluor. *Freyberg.*

### VARIETY III. AMORPHOUS.

XXV. *a* 1. In broad splendid laminæ, imbedded in and covering the surface of transparent calcareous spar. The surface of the exterior plate studded with numerous triangular facets. *Norway.*

XXVI. *a* 2. Partly superficial, and partly interspersed through brown indurated steatite. *Jobngeorgensstadt.*

XXVII. *a* 3. In small laminæ interspersed through opaque quartz, cellular on the surface and very minutely crystallised. The silver in this said to be rich in gold, therefore called *Electrum Nativum*. *Auriferous Native Silver*, Kirw. *Norway.*

XXVIII. *b* 1. In thin lamellæ, on the surface of grey hornstone. *Jobngeorgensstadt.*

XXIX. *b* 2. On blackish grey petro-felix. *Siberia.*

XXX. *b* 3. The same, on indurated white lithomarga. *Obermoschel.*

XXXI. *b* 4. Superficial and interspersed through a vein of galena and quartz, in gneiss. *Freyberg.*

XXXII. *b* 5. On grey petro-felix, with minutely crystallised quartz. *Siberia.*

XXXIII. *b* 6. Superficial and tarnished, on a micaceous schistus containing garnets. *Kongsberg.*

XXXIV. *c* 1. Nearly solid, amorphous, and of a dull colour, with calcareous spar. *Same place.*

XXXV. *c* 2. Interspersed through grey limestone, intermixed with yellowish green ray-stone, quartz, and yellow pyrites. *Norway.*

XXXVI. *c* 3. Imbedded in compact cinnabar. *Stahlberg, Sweden.*

XXXVII. *c* 4. In brown spathose tin ore, with quartz and ash-coloured indurated steatite. *South America.*

XXXVIII. *c* 5.

XXXVII. *c* 5. Forming an irregular granular mass, on semitransparent yellowish quartz. Norway.

## SPECIES II. ARSENICAL SILVER.

*Argent Arsenical*, Fr. *Arsenik Silber*, Germ.

This occurs either interspersed, or in lumps, or crystallised in truncated hexaedral prisms longitudinally striated. Its colour tin-white approaching to leaden grey; when tarnished, yellowish or steel grey. Its lustre metallic; fracture foliated, striated, or granular. It cuts easily with the knife, and is in a slight degree malleable, and very ponderous. Under the blow-pipe its arsenic is given out in the usual form of a white smoke with a foetid odour. It consists, according to the analysis of *Lafius*, of from 12 to 95 per cent. silver, the remainder regulus of arsenic, arsenicated iron, and antimony. It is generally accompanied with brittle vitreous silver ore, black silver ore, and brown blende in ponderous or calcareous spar, and has principally been met with at *Andreasberg* in the *Hartz*, and at *Kasalla* near *Guadalupe* in *Spain*. A specimen of the former analysed by *Klaproth*, furnished Silver 12.75, Iron 44.45, Arsenic 35, Regulus of Antimony 4; of the latter, by *Monet*, Silver 90, the remainder Arsenic and Iron without Antimony.

Allied to the foregoing, and by most considered as of the same species, is the antimoniated native silver (*Spiegelglas Silber*) which also occurs interspersed or in lumps, or in striated hexaedral or quadrangular prisms, of a silver or tin-white colour, and metallic lustre; subject, like the former, to tarnish on exposure to air; generally of a foliated or somewhat conchoidal texture, and of great weight, its specific gravity being estimated at 10,000. Its hardness is such as to give fire with steel. It amalgamates with quicksilver without heat. By the assistance of a boiling heat it is partially soluble in the nitric acid, but not in the oxymuriatic. Under the blow-pipe it fuses easily, and emits a greyish white smoke, devoid of arsenical odour, the remainder yielding a pure silver regulus on the addition of borax. According to the analysis of *Mr. Selb*, it consists of from 70 to 75 of Silver, with regulus of Antimony and a little Iron. It has as yet been only met with in the cavern of *St. Wenzel* near *Altwohlfach* in the principality of *Furstenberg*, accompanied by native silver, and ponderous or calcareous spar.

## VARIETY I. CRYSTALLISED.

XXXIX. *a* 1. In hexhedral prisms longitudinally striated on the surface and truncated at the extremities, with native silver and galena in white plated ponderous spar.

*Andreasberg, Hartz.*

XL. *a* 2. In larger and more massy crystals, in white ponderous spar.

*St. Wenzel, Furstenberg.*

XLI. *a* 3.

XLI. *a* 3. In rhomboidal plates, and also in truncated hexhedral prisms with galena and white ponderous spar covered by yellow oxyde of lead. *Same place.*

*b.* Indeterminate.

## VARIETY II. AMORPHOUS.

XLII. *a* 1. Of a foliated texture and tin-white colour, intermixed with galena and white ponderous spar. *Guadanalcanal, Spain.*

XLIII. *b* 1. Partly granular and partly laminated, in red silver ore and calcareous spar. *Hartz.*

XLIV. *b* 2. Granular, and partly of a yellow colour, in white ponderous spar interspersed with galena. *Furstenberg.*

*c.* Compact.

## SPECIES III. HORN SILVER.

*Argent Corné, Fr. Hornerz, Germ.*

This is found either in compact amorphous masses, in globules, or dispersed through other mineral substances, or lying on their surface in an earthy or powdery form, or in thin laminæ, but most frequently in small crystals. It is generally of a pearly grey, brownish, or bluish colour, sometimes of a dark olive green. Its semitransparency approaches in some instances to that of horn, though in general it is semitransparent only at the edges, or when in thin pieces. The form of its crystals is cubic; its surface smooth; texture compact; internal lustre somewhat unctuous or waxy. Specific gravity from 4.745 to 4.804. It yields in most instances to the nail, and in thin laminæ is found to be somewhat flexible, though sometimes brittle. It melts with great facility under the blow-pipe, and gradually evaporates; but by the addition of an alkali may be reduced without difficulty.

According to the analysis of *Klaproth*, it contains Silver 67.75, Muriatic Acid 21, Oxyde of Iron 6, Alumine 1.50, Lime 0.25, Sulphuric Acid 0.25. The *Buttermilk ore*, as it is called, which is no other than a variety of the horn ore, by the analysis of the same chymist, contains Silver 24, Muriatic Acid 8, Alumine 67, with some Oxyde of Copper. Horn silver ore is generally accompanied by the vitreous ores of silver, native silver, and often by ochre of Iron. It occurs in certain mines in *Saxony, Bohemia, and Siberia*: it has also been found in considerable quantities in *Cornwall*, but the richest and finest specimens are from *Cuexnabaca* in *Mexico*, and *Guamanga* in *Peru*.

VARIETY

VARIETY I. *CRYSTALLISED.*

XLIV. *a 1.* Very minutely crystallised, of an olive green colour, on indurated ochre; the crystals cubic, but variously truncated. *Cornwall.*

XLVI. *a 2.* In numerous small semitransparent brownish cubes on brown ochry argillaceous schistus. *Johnsgeorgenstadt.*

XLVII *b 1.* Confusedly crystallised on gneiss; the colour on one side of the specimen black, and on the other fawn colour. *Same place.*

VARIETY II. *AMORPHOUS.*

XLVIII. *a 1.* Lying superficially, with vitreous silver ore, on dendritic native silver in quartz. *Potosi in Peru.*

XLIX. *a 2.* Compact and without matrix. *Johnsgeorgenstadt.*

L. *b 1.* Of a pearl grey colour, laminated and superficial (*Buttermilk ore*) on calcareous spar. *Hartz.*

SPECIES IV. *VITREOUS SILVER.*

*Argent Vitreux ou Sulpureux, Fr. Glaferz, Germ.*

The usual colour of this ore is leaden grey, inclining more or less to the black, having internally a metallic splendour, and being on the surface often variously tarnished. It occurs either in irregular masses; interspersed, or superficial; or of particular shapes, as dendritic, ramose, filiform, &c. or crystallised in cubes or octohedrons with their variations. Its crystals are generally small, and, like those of native silver, often variously accumulated on each other. The fracture of this ore is for the most part compact, sometimes inclining to conchoidal. It is to a certain degree both malleable and flexible; generally so soft as to be cut easily with the knife, and sometimes to stain the fingers. By the streak it becomes more splendid. Its specific gravity from 6.909 to 7.215. It fuses when heated to redness, but if exposed to a gentle heat its sulphur is gradually dissipated. Its silver may also be obtained by fusion with four times its weight of potash. It is difficultly acted on by the nitric acid.

By analysis it is found to contain from 70 to 85 parts of Silver, and from 12 to 25 of Sulphur.

It

It is met with chiefly at *Kongsberg* in *Norway*; in the silver mines of *Sweden* and *Siberia*; as also in those of *Saxony*, *Bobemia*, and *Hungary*, where it goes under the name of *Weichgewaechs*.

This ore is justly considered as deriving its origin in most instances from the action of the vapour of sulphur upon native silver, by which it is so frequently accompanied, and in which the transitions from the native to the mineral state are often very apparent.

The *Silberschwärze* (black silver) or *Silbermulm*, which is found in a powdery form, or but slightly coherent, and of a black colour, is thought by *Baron Born* and some others to be only a variety of this ore.

#### VARIETY I. CRYSTALLISED.

LI. *a* 1. In cubes more or less perfect, branching from semitransparent lenticular calcareous spar. *Freyberg.*

LII. *a* 2. In large cubes variously truncated and irregularly aggregated, inclosing a detached octohedral crystal of brilliant yellow pyrites. *Same place.*

LIII. *a* 3. In cubes deeply truncated, forming crystals of 14 sides, with ash coloured calcareous spar and crystallised quartz, on grey blende. *Hungary.*

LIV. *a* 4. In small irregular truncated cubes, and also in octohedrons, with pearl coloured tabular calcareous spar, on quartz intermixed with yellow blende. *Hartz.*

LV. *a* 5. In aggregated cubes, with a quartz incrustation and pyrites, on ash coloured aluminous clay having the appearance of *Mountain Leather*. *Joachimsthal.*

LVI. *b* 1. In irregular octohedrons interposed between layers of crystallised quartz with lenticular calcareous spar. *Joachimsthal.*

LVII. *b* 2. In regular aggregated octohedrons, iridescent on the surface, adhering to grey quartz. *Joachimsthal.*

LVIII. *b* 3. In regular octohedrons, aggregated on galena. *Joachimsthal.*

LIX. *b* 4. In regular octohedrons of different sizes, truncated at their solid angles, and attached to the surface of long convoluted branches of native silver incrustated with vitreous silver ore, and minutely crystallised ash coloured pearl spar. *Freyberg.*

LX. *c* 1. In the form of a flat irregular plate, in several places minutely crystallised. *Freyberg.*

#### VARIETY

## VARIETY II. OF PARTICULAR SHAPES.

LXI. *a* 1. Partly dendritic and moss-like, partly solid and amorphous, and partly crystallised in small cubes variously truncated ; without matrix. *Freyberg.*

LXII. *a* 2. Dendritic, with galena in yellowish ponderous spar. *Same place.*

*b.* Ramose.

LXIII. *c* 1. In very fine capillary filaments, exhibiting a moss-like appearance ; without matrix. *Same place.*

## VARIETY III. AMORPHOUS.

LXIV. *a* 1. Of a laminated texture, with white calcareous spar and yellow pyrites. *Kongberg.*

*b.* Superficial.

LXV. *c* 1. In the mass, and without matrix.

LXVI. *d* 1. Interspersed through ash-coloured lime-stone (*Alkaline Silver Ore of M. Jushi*). *Hungary.*

LXVII. *d* 2. Intermixed with white calcareous spar and dendritic native silver. *Freyberg.*

## SPECIES V. BRITTLE VITREOUS ORE.

*Argent fragile*, Fr. *Spröd-Glaserz*, Germ. *Röschgewachs*, Hung.

This by many is considered as only a variety of the preceding species, to which it is very analogous in its colour, lustre, texture, hardness, form and weight ; its colour being greyish-black inclining to lead-grey, and, when tarnished, blue ; its lustre metallic ; its texture compact inclining to conchoidal ; yielding readily to the knife ; its form amorphous, interspersed, capillary, spongy, cellular, &c. and also occasionally crystallised ; specific gravity 7.208. It differs however from the vitreous ore in being brittle, and easily reducible into a black powder. Under the blow-pipe it yields a white sulphureous smoke, its silver being left behind accompanied with oxyde of iron, from which it may be purified by the addition of nitre and borax.

According to the analysis of *Klaproth*, it consists of Silver 66.5, Iron 5, Antimony 10, Sulphur 12, Copper and Arsenic 0.5, or by a later analysis, Silver 20.40, Lead 48.06, Regulus of Antimony 7.88, Iron 2.25, Sulphur 12.25, Alumine 7, Silica 0.25.

It is found in the same mines with the vitreous and red silver ores, and is by *Romé de*

*L'Isle* considered as the result of the decomposition of the latter approaching to the nature of the former.

### VARIETY I. CRYSTALLISED.

*a* 1. In hexhedral prisms or tables. *Widenmanns' Handbuch* P. 699, 700.

### VARIETY II. AMORPHOUS.

LXVIII. *a* 1. Of a steel grey colour and granular texture, having a porous or spongy appearance ; with ochry indurated clay. *Freyberg.*

LXIX. *a* 2. The same, with yellow pyrites and galena, on transparent rhomboidal tabular ponderous spar. *Hungary.*

LXX. *a* 3. Of a granular texture and tuberculated, with auriferous pyrites on grey quartz. *Schemnitz.*

LXXI. *b* 1. Of a spongy texture and granulated on the surface, partly of a foot-black, and partly of a steel-grey colour ; on grey cobalt ore intermixed with red oxyde of cobalt and yellow ochre. *Freyberg.*

*c.* Pulverulent.

### SPECIES VI. RED SILVER ORE.

*Argent rouge*, Fr. *Rothgultigerz*, Germ.

Of this modern authors make two varieties, the light coloured and the dark ; the light intermediate betwixt blood and cochineal red, and often variegated on the surface ; the dark holding the middle between dark cochineal red and bluish grey, and sometimes inclining to iron black. They both occur either in the mass, or interspersed, or superficial, sometimes of particular shapes, and often crystallised ; the light most commonly in acute double hexhedral pyramids, the dark in dodecahedrons with rhombic faces or in hexhedral prisms with trihedral pyramids. The crystals of the lighter coloured are more transparent than those of the other, which are sometimes nearly opaque ; the fracture of each is uneven, inclining to the conchoidal ; splendour vitreous, approaching to the metallic ; brittle. They yield a red streak, and when powdered become of a blackish colour ; specific gravity from 5.442 to 5.684. Under the blow-pipe they decrepitate, and melt before they become red hot, giving out a white sulphureous or arsenical smoke. According to the analysis of *Klaproth*, the light red silver ore of the *Hartz*, contains Silver 60, Sulphur 11.7, Sulphuric Acid 8, Regulus of Antimony 20.3 ; and that



that of *Freyberg* in *Saxony*, Silver 62, Sulphur 11, Sulphuric Acid 8.5, Regulus of Antimony 18.5; while the red silver ore analysed by *Bergman*, contained Silver 60, Arsenic 27, Sulphur 13. Varieties of both kinds are found in the silver mines of *Saxony*, *Bobemia*, *Hungary*, the *Hartz*, *St. Marie aux Mines* in *Alsace*, *Guadalcanal* in *Spain*, *Potosi*, &c. The dark coloured ore is found generally in the neighbourhood of native arsenic and of arseniated cobalt ores.

# VARIETY I. CRYSTALLISED.

LXXII. *a* 1. In dodecahedrons with rhombic faces, opaque, and of a dark red colour; on olive coloured decomposing iron pyrites. *Freyberg*.

*R. de L. Espece 3d, Var. 5th.*

LXXIII. *b* 1. In hexhedral prisms striated longitudinally and terminated by obtuse trihedral pyramids with rhombic faces, transparent, of a ruby colour and iridescent on the surface, forming a small irregular groupe without matrix. *Same place.*

*R. de L. Espece 3d, Var. 1st.*

LXXIV. *b* 2. Fragment of a large hexhedral prism terminated by an obtuse trihedral pyramid, semitransparent and of a blood red colour. *China.*

*R. de L. Espece 3d, Var. 1st.*

LXXV. *b* 3. In large hexhedral prisms terminated by trihedral pyramids, dark coloured and opaque; the prisms extremely short, irregularly aggregated, and having their surface incrustated with very minute crystals of the same, with white calcareous spar. *Marienberg.*

LXXVI. *b* 4. In minute hexhedral prisms with trihedral pyramids, of a light red colour, and transparent; on tuberculated iron pyrites. *Jobngeorgenstadt.*

LXXVII. *b* 5. In hexhedral prisms terminated by hexhedral pyramids, dark coloured and opaque; on amorphous red silver ore with cellular white quartz and calcareous spar. *Guadalcanal, Spain.*

*R. de L. Espece 3d, Var. 9th.*

LXXVIII. *b* 6. In numerous hexhedral prisms terminated by trihedral pyramids, the edges of which are deeply truncated, dark coloured and opaque; on decomposing iron pyrites. *Saxony.*

*R. de L. Espece 3d, Var. 2d.*

LXXIX. *b* 7. In regular hexhedral prisms terminated by hexhedral pyramids, brilliant

liant and opaque, with minutely crystallised transparent hexagonal truncated calcareous spar; on testaceous arsenic incrustated with red silver ore. *Hartz.*

*R. de L. Espece 3d, Var. 9th.*

LXXX. *b* 8. In large, dark, opaque, and irregularly aggregated hexhedral prisms terminated by hexhedral pyramids, with amorphous red silver ore, testaceous arsenic, and calcareous spar. *Andreasberg.*

LXXXI. *b* 9. In dark, opaque, and splendid hexhedral prisms, terminated by very obtuse trihedral pyramids, on the surface of amorphous red silver ore without matrix. *Hartz.*

LXXXII. *b* 10. In short irregular hexhedral prisms with hexhedral pyramids, opaque, and of a ruby colour, on the surface of amorphous red silver ore. *Same place.*

LXXXIII. *b* 11. In truncated hexhedral prisms, dark, opaque, and splendid; on calcareous spar. *Same place.*

LXXXIV. *c* 1. In double hexhedral pyramids, transparent, and of a ruby colour; on decomposing iron pyrites. *Marienberg.*

*R. de L. Espece 3d, Var. 9th.*

LXXXV. *c* 2. More minutely crystallised. *Same place.*

LXXXVI. *d* 1. In dark, opaque, and very brilliant pyramidal crystals variously interwoven, in some places apparently prismatic; intermixed with white cellular quartz. *Hartz.*

LXXXVII. *d* 2. In very minute crystals, incrusting lenticular calcareous spar of a cockscomb appearance. (*Rose of Jerico Spar.*) *Joachimstahl.*

LXXXVII. *d* 3. With lenticular calcareous spar and yellow pyrites. *Hungary.*

## VARIETY II. AMORPHOUS.

LXXXIX. *a* 1. Bright, transparent, compact and of a ruby colour, with testaceous arsenic; in solid white quartz. *St. Marie aux Mines.*

XC. *b* 1. Of a deep orange colour, superficial; on grey horn-stone. *Same place.*

## SPECIES

## SPECIES VII. WHITE SILVER ORE.

*Argent blanc*, Fr. *Weißgültigerz*, Germ.

The true colour of this ore is light lead grey approaching more or less to steel grey. It has hitherto been found only in the mass, or interspersed, and generally through galena; its texture granular or compact. It is opaque, and of a slight metallic splendour, rather soft, and not remarkably brittle. Specific gravity 5.322. Under the blow-pipe it in part evaporates, leaving a silver globule surrounded by yellow particles. By the analysis of *Klaproth* it contains Silver 20, Lead 40, Sulphur 12, Antimony 8, Iron 2.5, Alumine 7, Silica 0.5. It is found in certain of the mines of *Freyberg*, and at *Facebay* in *Transylvania*.

## VARIETY I. AMORPHOUS.

XCI. *a* 1. Steel grained and of a leaden grey colour, in galena intermixed with red silver ore.  
*Eisfeldorf* near *Freyberg*.

XCII. *b* 1. Compact and of a leaden grey colour, intermixed with grey calcareous spar; on yellowish ponderous spar.  
*Freyberg*.

To the foregoing species might now be added the *Silberglanz* of *Renovantz* (*Cupriferos sulphurated silver ore* of *Kirwan*, *Elem. Mineral.* vol. 2. pag. 121.) and the *Carbonate of Silver* discovered by *Selb* in the principality of *Furstenberg* in the year 1788, (Vide *Widenmann*, § 232.) The accidental admixture of native silver, vitreous silver, red silver ore, &c. with copper, iron, cobalt and other heterogeneous substances, are to be considered as mere varieties.

## GENUS V. LEAD.

*Plumbum*. *Plomb*, Fr. *Blei*, Germ.

Pure lead when fresh cut is of a bluish white colour, changing to yellowish white, bluish, and bluish black, upon exposure to the air. So soft as to yield even to the nail and to blacken the fingers upon handling. It makes a sensible impression both upon the organs of taste and smell, and on the latter more especially after being rubbed. It is more malleable than ductile, may without cracking be beaten into very thin plates, is inelastic, and of all the metals the least sonorous and the least tenacious. Its specific gravity according to *Briffon* is 11.352. By long exposure to a moist atmosphere it contracts a white rust from superficial oxydation, though little if it all affected when immersed in pure water. It melts before it becomes red hot at 540 *Farenh*. By a continuance

tinuance of the heat in open vessels it is easily converted into a grey, yellowish or reddish oxyde, which in the higher degrees of heat is not only itself capable of vitrification, but promotes remarkably that of the other imperfect metallic oxydes, and of all the earthy bodies; hence the refinement of gold and silver and the preparation of most of the finer kinds of glass. It is soluble in all the acids; in the diluted nitric acid without the assistance of heat. Its solutions have a sweetish astringent taste, and exhibit a dark brownish colour on the addition of an alkaline sulphuret.

With gold, silver, tin, and several other of the metallic bodies, it unites readily by fusion; it may also in this way be artificially combined both with sulphur and phosphorus.

Amongst the extensive applications of this metal are the manufacture of Shot, the composition of Pewter, and of Soft Solder, Glass-making, Glazing, Painting, Varnishing, &c. The ores of Lead are,

#### SPECIES I. NATIVE LEAD.

*Plomb natif*, Fr. *Gediegen-Blei*, Germ.

Lead is so seldom met with in this state, that by many celebrated mineralogists its existence has been called in question; but that it does now and then actually occur, is proved by the following specimen, No. II. from *Brittany*, as well as by one from *Monmouthshire*. (*Kirw. Vol. 2. Pag. 203.*) The native in its colour, texture, weight, fusibility, &c. so nearly resembles common lead as to render a particular description unnecessary.

#### VARIETY I. CRYSTALLISED.

I. Lead artificially crystallised.

II. *a 1.* In irregular layers of a dull leaden colour, composed of accumulated pyramidal crystals attached to the surface of laminated galena, with crystallised quartz underneath.

*Brittany.*

#### VARIETY II. OF PARTICULAR SHAPES.

*a 1.* Dendritic.

#### SPECIES II. NATIVE OXYDE OF LEAD.

*Oxide de Plomb spatique rouge*, Fr. *Rotb-Bleierz*, Germ.

This occurs for the most part in semitransparent brilliant prismatic crystals, of an aurora red colour resembling that of realgar, and sometimes inclining to the hyacinth. The form

form of the crystals, the tetrahedral rhomboidal prism with trihedral or dihedral summits. Its texture scaly; brittle; when powdered becoming of an orange yellow colour. Specific gravity 6.026. It does not effervesce with acids; the marine, which acts on it most readily, dissolves about one sixteenth its weight. Under the blowpipe it decrepitates, and the greater part may at length be converted into a black slag which imparts a greenish colour to glass of borax: mixed with charcoal it inflames in a red heat, and undergoes reduction. It contains, according to the analysis of *Bindheim*, Lead 60, Molybdenic Acid 11.66, Nickel 5.66, Oxyde of Iron 1, Silica 4.5, Air and Water 5, and a small proportion of Copper and Cobalt; and of *Maquart*, Lead 36, Oxygen 37, Iron 24, Alumina 2. It is principally found with yellowish lead ore and shattery quartz, on a micaceous sandstone, near *Katbarinenberg* in *Siberia*; it has also lately, as it is said, been met with at *Reczbanya* in *Hungary*, and at *Trappetes* in *Upper Faucigny* in *Savoy*.

#### VARIETY I. CRYSTALLISED.

III. *a* 1. In transparent tetrahedral rhomboidal prisms terminated by dihedral pyramids, of an aurora red colour, on whitish ferruginous quartz.

*R. de L. Pl. 4. Fig. 28.*

*Berejskoi near Katbarinenberg, Siberia.*

IV. *a* 2. The same, on a micaceous ochry sandstone.

*Same place.*

*b.* Indeterminate.

#### VARIETY II. AMORPHOUS.

*a.* Compact.

V. *b* 1. In an earthy friable form, and of a bright tile red colour (*Native Minium*), in cellular quartz.

Probably also from *Siberia*.

#### SPECIES III. CARBONATE OF LEAD.

*White Spathe Lead Ore. Plomb Spathe, Fr. Weiss-Bleierz, Germ.*

The colour of this ore is silver white with considerable splendour, often, from accidental admixture or decomposition, inclining more or less to yellow, grey, green or brown. It generally occurs in slender prismatic crystals, often intimately interwoven or decussating each other, and not unfrequently in aggregated crystalline masses, more rarely stalactitical, in lumps, disseminated, or superficial. The form of its crystals is derived from the double hexhedral pyramid with triangular faces. When crystallised, usually transparent;

parent; the smaller crystals being of a fibrous or splintery fracture, the larger conchoidal. It is brittle and scratches easily with the knife. Specific gravity of the most transparent from 6.25 to 6.92, of the opaque from 4.058 to 5.84. It is readily soluble with effervescence in the diluted nitric acid; it is also soluble in fat oils by the assistance of heat. When exposed to the vapour of sulphuret of ammonia it becomes of a dark colour, by which it is distinguished from all other apparently similar substances. Under the blow-pipe it decrepitates and becomes an oxyde of a yellowish colour inclining to red, and of very easy reduction. According to the analysis of *Westrumb*, it contains Lead 80.25, Carbonic Acid 16, with some Lime, Alumine, and Iron.

The most beautiful specimens of this ore have been found at *Gluckfrade* in the *Hartz*; it also occurs in considerable quantity in the mines of *Saxony*, *Bobemia*, *Brittany*, *Carinthia*, &c.; rich specimens are likewise to be found in *Wales* and *Ireland*, and more especially at *Lead Hills* in *Scotland*.

#### VARIETY I. CRYSTALLISED.

VI. *a* 1. In dodecahedral crystals composed of two hexhedral pyramids joined base to base, the surface brilliant, and having a metallic lustre, on galena intermixed with fluor.

*Derbyshire.*

VII. *a* 2. In large white semitransparent crystals mostly irregular or in macles, some however simple and distinctly composed of two hexhedral pyramids joined base to base with short intermediate prisms, on galena with grey limestone. *Przibram, Bobemia.*

*R. de L. Pl. 6. Fig. 21, 22, 23.*

VIII. *a* 3. In numerous transparent hexhedral prisms terminated by hexhedral pyramids, on black decomposing galena.

*Brittany.*

IX. *a* 4. In large irregular hexhedral prisms, fasciculated, and intermixed with stactitical pyrites, the surface of which is black and partly incrustated with brownish phosphate of lead in stellated prismatic needles.

*Poullaoven.*

X. *a* 5. The fragment of a large transparent hexhedral crystal.

*Mendip Hills, Somersetshire.*

On this fragment are two distinct faces, one measuring three quarters and the other an inch and a half in breadth and two and a half in length; weight upwards of eight ounces.

XI. *a* 6. In small irregular flatted hexhedral prisms terminated by similar pyramids, covering the surface of cubic galena, with white ponderous spar underneath. *Poullaoven.*

XII. *a* 7.

XII. *a* 7. In flatted hexhedral prisms of a striated texture and terminated by tetrahedral pyramids, the broad sides of which correspond with those of the prism, the crystals variously attached and interwoven. *Bleyfield, Hartz.*

XIII. *b* 1. In numerous short semitransparent prismatic crystals truncated at both extremities and grooved longitudinally, adhering laterally to the surface of grey decomposing galena. *Hartz.*

The grooved appearance on the surface of these crystals evidently arises from the projecting edges of small prismatic crystals of which the larger are composed.

XIV. *b* 2. In small sheaves or fasciculi, composed of prismatic needle-like crystals truncated at their extremities and united in various directions, some parallel, some diverging, some transverse, &c. on ochry cellular quartz. *Hartz.*

XV. *b* 3. The same, in finer crystals also on ochry quartz, with green oxyde of copper on the surface. *Same place.*

XVI. *b* 4. Of a mother-of-pearl colour (having somewhat the appearance of Zeolite), in which the long slender prismatic truncated crystals, diverging from different centres, meet in various points and curiously decussate each other. *Same place.*

XVII. *b* 5. In an assemblage of snow white needle-like crystals, variously attached and interwoven. *Gluckstadt, Hartz.*

*Catal. de Raab XIII D. b. a. 3.*

XVIII. *b* 6. The same, in very delicate crystals on blackish ferruginous quartz. *Same place.*

XIX. *b* 7. The same, incrustated with green carbonate of copper, on a similar matrix with the last. *Same place.*

XX. *b* 8. The same, in larger crystals, incrustated also with green copper ore. *Same place.*

XXI. *b* 9. The same, thickly incrustated with radiated green carbonate of copper on spongy quartz. *Same place.*

XXII. *b* 10. In flatted aggregated crystals without matrix. *Lead Hills.*

XXIII. *b* 11. Of a dull white colour fasciculated in various directions, in ochry quartz. *Wales.*

XXIV. *b* 12. In a closely aggregated mass of a yellowish white colour, composed of striated prismatic crystals more especially distinct on the surface. *Lead Hills.*

XXV. *b* 13. In a mass composed of crystals, more compacted and of a whiter colour. *Same place.*

XXVI. *b* 14. The same, in a smaller mass of a more confused structure. *Derbyshire.*

#### VARIETY II. AMORPHOUS.

XXVII. *a* 1. In a ponderous mass, composed of diverging striæ of a dull white colour. *Hartz.*

XXVIII. *b* 2. In a laminated irregular mass, of an ochry yellow colour, formed on decomposing galena. *Freyberg.*

XXIX. *c* 1. In a solid irregular ponderous mass of a yellowish dull white colour, tuberculated on the surface. *Brittany.*

XXX. *c* 2. The same, of a light ash colour, less ponderous and without tubercles. *La Croix aux Mines.*

XXXI. *c* 3. The same, more compact and ponderous, of a light yellowish-brown colour. *Scotland.*

#### VARIETY III. PASSING INTO GALENA.

*Oxyde de Plomb Spathique gris.* Catal. de Raab. Tom. 2. P. 373. *Mine noir Romé de l'Isle,* Crystall, Tom. 3, P. 400.

XXXII. *a* 1. In large truncated hexhedral prisms, of a greyish brown colour, issuing from a cavernous mass of grey lead ore. *Poullaoven.*

XXXIII. *a* 2. In large diverging fasciculi, composed of truncated hexhedral prisms of the same colour, incrustated on their surface by brownish spathose lead ore. *Same place.*

XXXIV. *b* 1. In large irregular aggregated prisms, covered on the surface by white spathose lead ore minutely crystallised. *Same place.*

XXXV. *b* 2.



XXXV. *b* 2. In a small irregular mass composed of short truncated prisms, in some places having white saphire lead ore interposed. *Tschopau.*

*Vide* Phosphorated Lead Ore, SPECIES v.

XXXVI. *b* 3. In needle like prisms, lying in various directions on the surface of ochry quartz. *Hartz.*

#### SPECIES IV. MOLYBDATE OF LEAD.

*Yellow Lead Ore of Carinthia. Mine de Plomb jaune, Fr. Gelb-Bleierz, Germ.*

This generally occurs in tabular crystals, varying in colour from pale yellow to orange, with more or less transparency, and of a waxy lustre. Its crystals are seldom large, often aggregated into compact or cellular masses; when perfect their form is cubic or octohedral. Its texture is sparry; it yields easily to the knife, and is brittle. Specific gravity 5.092. It is soluble both in the nitric and muriatic acids by the assistance of heat, and may be decomposed in the moist way by either of the fixed alkalis. Under the blow pipe it readily decrepitates, and melts into a dark coloured mass, which fluxed with borax or microcosmic salt communicates to them a greenish or deep blue colour. According to the late experiments of *Mr. Hatchett*, this ore consists of Oxyde of Lead 58.4, Molybdic Acid 38, Oxyde of Iron 2, with a small proportion of Silica. It is found at *Villach* in *Carinthia*, on a matrix of limestone of a pale brownish grey colour, and tinged frequently with oxyde of iron.

#### VARIETY I. CRYSTALLISED.

XXXVII. *a* 1. In tabular orange coloured crystals, mostly confused, but some distinctly octohedral, others tetrahedral, and all with bevelled edges, on compact ochry limestone. *Bleyberg, near Villach, Carinthia.*

*R. de L. Pl. 3, Fig. 37.*

XXXVIII. *b* 1. In lenticular tables of a dull yellow colour, set edgewise on a similar matrix. *Same place.*

#### SPECIES V. PHOSPHATE OF LEAD.

*Mine de Plomb vert, Fr. Grün-Bleierz, Germ.*

The most common colour of this ore is green of various shades; it is also often brownish or greenish yellow, greyish or brownish red. It occurs occasionally in lumps,

of particular shapes, or interspersed, but most frequently more or less distinctly crystallised; the form of its crystals the hexhedral prism, with or without hexhedral pyramids and their modifications. It has a waxy lustre, and varies in its degree of transparency. Scratched with the knife it gives a greenish white streak; is brittle; of an uneven fracture approaching to conchoidal. Specific gravity from 6.076 to 6.593. It dissolves with slight effervescence in the diluted marine acid by the assistance of heat. It melts easily under the blow-pipe; to glass of borax it communicates a yellowish white colour, and if heated with charcoal emits luminous phosphoric vapours, and is in part reduced. It may also be reduced by admixture with the mineral alkali. According to the analysis of *Klaproth*, the green lead ore of *Tschopau* contains Lead 72.08, Phosphoric Acid 18.74, Iron 1.5, and the rest Oxygen. It is met with sometimes in considerable quantities in the mines of *Siberia*, *Bohemia*, *Saxony*, *Brittany*, and many other parts. In some of the lead mines of *Ireland* and of *South Wales* it occurs not unfrequently, and more especially at *Lead Hills* in *Scotland*.

#### VARIETY I. CRYSTALLISED.

XXXIX. *a* 1. In hexhedral prisms of a yellowish grass green colour, terminated by acute hexhedral pyramids; the crystals very numerous and many of them extremely minute, in lamellated ochry quartz,  
*Freyberg, Brissgau.*

*R. de L. Espece 4, Var. 1.*

XL. *a* 2. In large aggregated hexhedral prisms terminated by obtuse hexhedral pyramids truncated near their base, of an olive green colour, on ochry ponderous spar.

*R. de L. Pl. 6, Fig. 46.*

*Tschopau.*

XLI. *a* 3. In smaller truncated hexhedral prisms of a yellowish grass green colour, on a similar matrix.

*Same place.*

*R. de L. Pl. 4, Fig. 18.*

XLII. *a* 4. In hexhedral crystals somewhat pyramidal, lying in various directions, and at their larger extremities irregularly truncated and hollowed, aggregated into an irregular mass of a yellowish grass green colour.

*Freyberg.*

XLIII. *a* 5. In short truncated and rounded hexhedral prisms of the same colour with the former, on ochry ponderous spar.

*Newtown Ards, Downshire.*

XLIV. *a* 6. In short hexhedral prisms truncated at both extremities, very distinct and numerous, of an olive green colour, on the surface of dark brown hematite.

*R. de L. Pl. 4, Fig. 18, 19, 20.*

*La Croix, Loiraine.*

XLV. *a* 7:

XLV. *a* 7. In truncated hexahedral prisms, small in size, of a pale greenish yellow colour, on coarse brown hematite. *Cornwall.*

XLVI. *a* 8. The same, in an aggregated mass, with pulverulent bright yellow ochre. *Tschopau.*

XLVII. *b* 1. Minutely crystallised, of a greyish green colour and tuberculated, on the surface of ochry spongy quartz. *Freyberg.*

XLVIII. *b* 2. The same, of a perfect grass green colour, having a stalactitical appearance (*Mamelloni*) on a whitish ochry sandstone. *Hofergrund, Freyburg.*  
*Catal. de Raab 13 D. b. d. 2.*

XLIX. *b* 3. Of a greenish yellow colour, in very minute and numerous diverging spiculæ, forming a kind of incrustation on the surface of greyish friable quartz. *Freyberg.*

L. *b* 4. Of a dark fawn colour, in numerous diverging fasciculi, composed of prismatic needle-like crystals, variously attached and interwoven, so as to form a moss-like or arborescent mass, from the interstices and surfaces of which shoot innumerable delicate spiculæ. *Huelgoet, Poullaoven, Brittany.*

LI. *b* 5. In detached and flatted fragments of a bright wax yellow colour. *Hungary.*

## VARIETY II. AMORPHOUS.

LII. *a* 1. Of a pale greenish yellow colour and earthy texture. *Lead Hills, Scotland.*

LIII. *a* 2. Of an orange colour, forming a cellular incrustation on decomposing galena. *Same place.*

LIV. *a* 3. Forming a tuberculated incrustation, semitransparent and of a yellowish brown colour, on compact galena. *Poullaoven.*

LV. *a* 4. In a ponderous irregular mass of a yellowish brown colour. *Scotland.*

LVI. *a* 5. Of a sulphur yellow colour, incrusting the surface of prismatic white lead ore, irregularly aggregated. *Same place.*

## SPECIES

## SPECIES VI. SULPHATE OF LEAD.

*Vitriolated Lead, Withering.*

This combination of oxyde of lead with sulphuric acid occurs in small transparent crystals, of a yellowish white colour and of considerable brilliancy; their form the octohedron and its modifications. It is easily scratched with the knife; specific gravity according to *Delametherie* 3.215. Soluble in about 1200 parts of boiling water. Under the blow-pipe it is readily reduced. According to *Dr. Withering*, by whom this ore was first analysed, it contains 70 per cent. of Lead with Sulphuric Acid and Iron. This ore has only been met with at *Paris Mine* in the *Isle of Anglesea* in the hollows of a brown ferruginous matrix.

## VARIETY I. CRYSTALLISED.

LVII. *a* 1. In small brilliant transparent octohedrons, on a ferruginous matrix.  
*Theorie de la Terre, par Delameth. Tom. 1. Page 293. Anglesea.*

LVIII. *a* 2. In large transparent octohedrons having a greenish tinge, on ochry decomposing galena.  
*Zellerfeld, Hartz.*

From the weight, transparency, figure, and more especially from comparative experiments made by the blow-pipe, these crystals appear similar to the above.

LIX. *b* 1. In indeterminate tabular crystals, aggregated on decomposing galena.  
*Same place.*

## SPECIES VII. SULPHURET OF LEAD.

*Potters Lead Ore. Galene, Fr. Bleyglanz, Bleisbweif, Germ.*

This occurs the most commonly, and is found in the greatest abundance of all the ores of lead, which it so exactly resembles in its lustre and colour as scarcely to be distinguished from it by the aspect. Its texture is for the most part foliated, sometimes granular or compact, the foliated easily separable into rectangular tessular fragments. It is opaque, is readily scratched by the knife, gives a shining bluish grey streak, and is very ponderous, its specific gravity being from 6.565 to 7.786. It is found in large masses or in veins, superficial, interspersed, or of particular shapes, and very frequently more or less distinctly crystallised; its form the cube and octohedron with their modifications. It is decomposed with effervescence both by the nitric and muriatic acids. Under the blow-

blow-pipe it first decrepitates, then fuses, emits a sulphureous smoke, and is afterwards reduced into a metallic globule, which contains generally a greater or less proportion of Silver and Iron. It is stated by Mr. Kirwan to yield from 45 to 83 per cent. of Lead, the remainder principally Sulphur. Besides the great abundance in which this ore is met with in various parts of *Germany, Sweden, Norway, Poland, &c.* it is raised with us in very large quantities in *Cornwall, Derbyshire, Cumberland, Northumberland, &c.* and also in *Scotland and Ireland.*

#### VARIETY I. CRYSTALLISED.

LX. *a* 1. In large distinct cubes of a dull greyish colour on the surface, on a plate of semitransparent white quartz. *Charles Mine, Sweden.*

LXI. *a* 2. In smaller cubes of various sizes, aggregated irregularly one on the other, the surfaces of the cubes covered by an incrustation of minute crystals of white spathose lead ore, on white opaque ponderous spar. *Derbyshire.*

LXII. *a* 3. In cubes and rectangular parallelepipeds, with brilliant crystallised blende intermixed with yellow copper pyrites and quartz. *Hungary.*

LXIII. *a* 4. In rhombs having their surfaces incrustated with minutely crystallised fluor, with transparent yellow and white cubic fluor on greyish limestone. *Derbyshire.*  
*R. de L. Espece 2, Var. 2.*

LXIV. *a* 5. In aggregated cubes the solid angles of which are slightly truncated, with crystallised transparent quartz, on white quartz mixed with dark grey schistus. *Hartz.*  
*R. de L. Espece 2, Var. 3. Pl. 2, Fig. 5.*

LXV. *a* 6. The same, having the angles more deeply truncated, on cubic fluor and quartz. *Freyberg.*

LXVI. *a* 7. In aggregated cubes truncated so deeply that their faces again become cubic, with an ochry incrustation on whitish indurated clay. *Bleyberg.*  
*R. de L. Espece 2, Var. 4. Pl. 2, Fig. 7.*

LXVII. *a* 8. The same, with a crystallization extremely regular, blackish and without lustre on the surface, on ferrugineous sandstone. *Joyngeorgenstadt.*

LXVIII. *a* 9. In large and shining crystals, still more deeply truncated, producing six quadrangular and eight hexangular faces, with cubic arsenical pyrites. *Freyberg.*  
*R. de L. Espece 2, Var. 5. Pl. 2, Fig. 9.*

LXIX. *b* 1.

LXIX. *b* 1. In regular octohedrons, on a mass of lamellated galena intermixed with numerous crystals of white spathose lead ore.

*Derbyshire.*

*R. de L. Espece 2, Var. 7. Pl. 3, Fig. 1.*

LXX. *b* 2. In octohedrons variously imbedded in one another, and aggregated into an irregular mass.

*Johnsgeorgensstadt.*

LXXI. *b* 3. The same, iridescent, having their apices slightly truncated, imbedded in lamellated galena with fluor.

*Saxony.*

*R. de L. Pl. 3, Fig. 3.*

LXXII. *b* 4. In numerous octohedrons, some cuneiform (*R. de L. Pl. 3, Fig. 2.*) some compressed (*Pl. 3, Fig. 12.*) some with all their solid angles slightly truncated (*Pl. 3, Fig. 4, 5.*) the whole on gneiss intermixed with galena.

*Freyberg.*

LXXIII. *b* 5. The same, of an iridescent appearance, having their solid angles slightly truncated, with arborescent galena, yellow pyrites, blende and double pyramidal calcareous spar, on reddish brown limestone.

*Leicestershire.*

*R. de L. Pl. 3, Fig. 4.*

LXXIV. *b* 6. The same, with numerous specks of white opaque ponderous spar, on white calcareous spar.

*Derbyshire.*

LXXV. *b* 7. In octohedrons having all the edges truncated, with whitish brown laminated spathose lead ore, on grey schistus.

*Saxony.*

*R. de L. Pl. 3, Fig. 7.*

LXXVI. *b* 8. In large aggregated octohedrons truncated both at their angles and edges, with brown scaly blende.

*Derbyshire.*

*R. de L. Espece 2, Var. 12. Pl. 3, Fig. 8.*

LXXVII. *c* 1. In indeterminate polyhedral crystals confusedly aggregated and very brilliant, on yellow pyrites mixed with black blende.

*Capnick in Hungary.*

This galena said to be rich in silver.

LXXVIII. *c* 2. The same, with crystallised transparent quartz, on reddish ponderous spar intermixed with quartz.

*Freyberg.*

LXXIX. *c* 3. The same, having several of their surfaces depressed like melted lead which has contracted in cooling (*renfoncé*), with pyramidal quartz, also on reddish ponderous spar intermixed with quartz.

*Same place.*

LXXX. *c* 4.

LXXX. c 4. The same, similar in appearance with the last, with calcareous spar on quartz. *Freyberg.*

VARIETY II. OF PARTICULAR SHAPES.

LXXXI. a 1. Forming a hollow stalactite ochry on the surface. *Derbyshire.*

VARIETY III. AMORPHOUS.

LXXXII. a 1. Of a tessellated structure, very brilliant and without matrix. *Same place.*

LXXXIII. a 2. Of a foliated texture, also very brilliant, with white lead ore on the surface. *Scotland.*

LXXXIV. a 3. The same, having a peculiar tarnish on the surface. *Bohemia.*

LXXXV. a 4. Of a foliated texture, intermixed with red ochre of iron.

LXXXVI. a 5. The same, iridescent on the surface and partly covered by white pearl spar. *Northumberland.*

LXXXVII. a 6. The same, with a brilliant surface having a tinge of brown, on white opaque baroselenite. *Derbyshire.*

LXXXVIII. a 7. In thin diverging laminæ, somewhat iridescent on the surface. *Saxony.*

LXXXIX. a 8. Of a foliated structure, having the surface covered by very minute crystals of galena singularly iridescent. *Brittany.*

XC. a 9. Of a foliated structure, with horn silver. *Johnsgeorgenstadt.*

This ore is said to be very scarce, and is remarkable for yielding sulphur on the application of a gentle heat.

XCI. a 10. Of a foliated texture and strongly iridescent, with white quartz, forming vein in indurated clay. *Bleystadt, in Bohemia.*

XCII. a 11. Of a foliated texture, the edges of the folia producing a nitted appearance, intermixed with purple fluor. *Saxony.*

XCIII. a 12. The same, of a brown tinge, the edges of the laminæ giving it a more striated appearance, in some places stalactitical. *Freyberg.*

XCIV. *b* 1. Of a coarse steel grained texture, very brilliant in its fracture.  
The *Levant*.

XCV. *b* 2. Of a fine steel grained texture. *Hartz.*

XCVI. *b* 3. Of a granular texture, intermixed with quartz and yellow pyrites.  
This variety becomes phosphorescent on being rubbed.

XCVII. *c* 1. Compact and mixed internally with yellow copper pyrites. *Same place.*

XCVIII. *d* 1. Superficially smooth and specular (*Sliken-Sides*) on white opaque quartz.  
*Odin Mine, Castleton.*

XCIX. *e* 1. Forming very minute parallel veins in ash-coloured sandstone.  
*Ilay, in the Hebrides.*

#### VARIETY IV. PASSING INTO PHOSPHATE OF LEAD.

C. *a* 1. In decomposing cubes, incrusting with dull yellowish white phosphate of lead.  
*Freyberg.*

#### SPECIES VIII. ANTIMONIATED LEAD ORE.

*Galene Antimoniale*, Fr. *Strablichter Bleiglanz*, Germ.

This differs from common galena in being less splendid on the surface, and most commonly of a striated or fibrous texture. Under the blow-pipe, it gives out a white oxyde of antimony in the form of light white flocculi. *Mr. Kirwan* has stated it to contain Lead from 40 to 50 per cent. with a small proportion of Antimony and a little Silver. It is found in the mines of *Siberia* and *Sweden*, at *Schemnitz* in *Hungary*, at *Lautenthal* in *Saxony*, &c. and at *Synares* in *Andalusia* in *Spain*.

#### VARIETY I. AMORPHOUS.

CI. *a* 1. Of a striated texture and iridescent. *Freyberg.*

CII. *b* 1. Of a foliated texture and dark grey colour. *Saxony.*

CIII. *c* 1. Compact, and of a light grey colour. *Freyberg.*

#### GENUS



## GENUS VI. COPPER.

*Cuprum. Cuivre, Fr. Kupfer, Germ.*

Copper, when pure, is of a dull or muddy red colour somewhat inclining to yellow, less splendid than silver or gold, but more so than iron. Its fracture granular. When heated or rubbed it exhales a disagreeable odour, and applied to the tongue impresses it with a nauseous somewhat styptic taste. It is considerably less ductile and malleable than gold or silver, but in hardness and elasticity inferior only to iron. Its toughness such, that a wire of  $\frac{1}{8}$  inch diameter supports a weight of  $299\frac{1}{2}$  pounds. It is the most sonorous of all the metals. Its specific gravity from 7.708 to 9.324. Upon exposure to moist air it quickly tarnishes, and in process of time acquires a greenish rust more or less compact. When heated to redness it is converted into a brown scaly oxyde. It melts at 27 *Wedgw.* = to 4587 *Fahrenb.* and being partly volatilised communicates a bluish green colour to the flame. Of all metals it is the most readily affected by both acids and alkalis; with the former it produces in most instances blue or green crystallisable saline compounds, and with ammoniac one which is of a beautiful blue colour. It is also readily acted upon by expressed oils and animal fats, particularly by those most liable to become rancid. It may be precipitated from all the acids by means of iron and zinc, and also by the alkalis and soluble earths. Under fusion it combines with the other metallic substances in various proportions. Silver and gold when alloyed with it, though rendered harder, lose little or nothing of their malleability, but tin it makes more brittle. It heightens the colour of gold, is itself whitened by arsenic, and is rendered paler or changed to a yellow by zinc. Melted with sulphur it forms a greyish-black friable mass more fusible than copper alone. Its oxyde tinges glass of an emerald green. Next to iron, copper is the most extensively employed of all the metals, in the arts, manufactures, domestic uses, and medicine.

## SPECIES I. NATIVE COPPER.

*Cuivre natif, Fr. Gediegen-Kupfer, Germ.*

The colour, texture, splendour, and other properties of this differ in no material respect from those of the pure metal. It occurs in amorphous masses; in plates more or less extensive; of particular shapes, as dendritic, ramose, filiform &c. and not unfrequently crystallised in small cubes or octohedrons and their modifications. Its crystals,

like those of native gold and silver, being often compacted into plates or accumulated on each other so as to form branches. It is found, sometimes in considerable quantity, in *Siberia* and *Canada*; on the *East Coast* of *Kamtschatka*; in various parts of *Norway* and *Sweden*; in *Japan*; in *Upper Hungary*, and the *Bannat*; in several of the mines of *Saxony*, *Bohemia*, and other parts of *Germany*; in *Baygory* and other parts of *Spain* and *France*; at *Redruth* in *Cornwall*, and many other places: but the largest mass as yet ever discovered is that mentioned by *Professor Vandelli* from a valley near *Cachoeira* in the *Brazils*, weighing upwards of 2600 Portuguese pounds. Besides the various other substances with which native copper is associated, as quartz, fluor, ponderous spar, &c. it is generally intermixed or incrustated with red or brown oxydes of copper or of iron, and often also with green or blue carbonate of copper.

#### VARIETY I. CRYSTALLISED.

- I. Pure copper artificially crystallised on the surface.
- II. *a* 1. In regular cubes aggregated into irregular branches, entangling fragments of micaceous quartz.  
*Bannat.*  
*Catal. de Raab. 12. A. d. 1.*
- III. *a* 2. In irregular cubes forming aggregated branches, and without matrix.  
*Chevigny.*
- IV. *b* 1. In numerous small regular octohedrons, on the surface of an irregular granulated mass of native copper.  
*Cornwall.*  
*Catal. de Raab. 12. A. d. 2.*
- V. *c* 1. In large indeterminate crystals, forming irregular connected branches of native copper intermixed with white quartz.  
*Hungary.*

#### VARIETY II. OF PARTICULAR SHAPES.

- VI. *a* 1. Dendritic and brilliant, in the form of moss, on ochry indurated clay.  
*Kamtsdorf.*
- VII. *a* 2. In fine dendritic and brilliant plates, with fragments of white quartz.  
*Cornwall.*
- VIII. *b* 1. In lengthened wire-like threads variously interwoven. *Same place.*
- IX. *b* 2. Ramose and covered by compact red and green copper ore. *Kamtsdorf.*
- X. *b* 3. Similar to the last, from *Mexico.*
- XI. *b* 4.

XI. *b 4.* A larger specimen of the same, in which the green copper ore is so compact as to have a semitransparent glassy appearance. *Siberia.*

XII. *b 5.* Ramose, in white calcareous spar. *Norway.*

XIII. *b 6.* The same, on compact native copper without matrix. *North America.*

XIV. *b 7.* Solid, in a flatted irregular plate somewhat branched and without matrix. *Cornwall.*

*c.* Filiform.

### VARIETY III. AMORPHOUS.

XV. *a 1.* In thin lamellæ, disseminated through white plated ponderous spar. *Lorraine.*

XVI. *b 1.* Granular and superficial, with laminated red copper, on decomposed granite. *Cornwall.*

XVII. *b 2.* The same, on white fat quartz.

XVIII. *c 1.* Compact and of a fine grain, intermixed with indurated clay and green copper ore. *Kamsdorf.*

XIX. Precipitated in an arboresecent form from its solution by means of iron.  
(*Cement-Copper.*)

### SPECIES II. NATIVE OXYDE OF COPPER.

*Tile Ore, Ruby Copper. Cuivre oxidé rouge, Fr. Ziegelerz, Roth-Kupfererz. Germ.*

Is of a brownish or cochineal red colour, inclining occasionally to yellow, and often resembling that of bricks or tiles, whence called *Tile Ore*. It occurs more or less indurated, either interspersed or in lumps, or investing or lining the fissures of other copper ores, or crystallised in small splendid rectangular octohedrons, or in delicate capillary crystals variously interwoven. The amorphous has an earthy fracture, is brittle; opaque, and of but little lustre. The more indurated is often in its fracture imperfectly conchoidal, and becomes more splendid by the streak. Its specific gravity according to *Gellert* 3.572. This ore generally dissolves with effervescence in the nitric acid, and on the subsequent addition of ammoniac affords a reddish or yellowish brown precipitate, which on standing acquires a blue tinge. Under the blow-pipe it blackens and is found to be very difficult of fusion. To glass of borax it communicates a yellowish or dull green colour. It appears to consist chiefly of Oxyde of Copper in mixture with Oxyde of Iron; in

the crystallised however, which is generally accompanied with native copper, the proportion of Iron is comparatively small. It is principally met with at *Moldava* and *Ora-viza* in the *Bannat*, at *Great Kamisdorf* in *Saxony*, at *Lauterberg* in the *Hartz*, at *Saalfeld* and *Blankenberg* in *Thuringia*, at *Catharinenberg* and many other of the mines of *Siberia*, and at *Redruth* in *Cornwall*.

#### VARIETY I. CRYSTALLISED.

XX. *a* 1. In detached rectangular octohedrons of a red colour, covered by green copper ore. *Siberia.*

XXI. *a* 2. In very regular octohedrons, semitransparent, on red copper ore, intermixed with native copper and compressed into a thick irregular plate of a granular texture. *Cornwall.*

XXII. *a* 3. The same, of a brilliant lustre, truncated at all their solid angles and intermixed with native copper, in white shattery quartz. *Same place.*

XXIII. *b* 1. In delicate silky fibres of a carmine colour, with white quartz, having white clay on the surface. *Rhein Breitenbach, Germany.*

#### VARIETY II. AMORPHOUS.

XXIV. *a* 1. In coarse irregular grains of a brownish red colour, disseminated through whitish shattery quartz. *Cornwall.*

XXV. *a* 2. In a flattened mass of a granular texture and dark reddish brown colour, coated on each surface with white opaque quartz. *Same place.*

XXVI. *b* 1. In small shining scales of a dull red colour, in white cellular quartz. *Same place.*

XXVII. *c* 1. In a compact irregular mass, of an earthy appearance and brownish red colour. (*Ziegelerz*.) *Bannat.*

XXVIII. *c* 2. The same, also of an earthy form, with grey copper ore, in reddish compact limestone. *Same place.*

XXIX. *c* 3. The same, with fibrous green copper ore, ponderous spar and quartz. *Schwartzberg.*

XXX. *d* 1.

XXX. *d 1.* In a friable mass of an ochry yellow colour and earthy texture.

*Kamsdorf.*

### SPECIES III. PITCH COPPER ORE.

A more exact examination of this ore shews it to be no other than a variety of the indurated *Tile Ore*, more compact and shining. By many it is described as a dark yellowish brown Limestone impregnated with Oxyde of Copper. *Kirwan* considers it as tile ore, impregnated with Bitumen. It is found principally at *Moldava*, *Saska*, and *Temeswar* in the *Bannat*.

#### VARIETY I. AMORPHOUS.

XXXI. *a 1.* Of a shining conchoidal fracture and liver brown colour, tuberos on the surface and intermixed with green and blue carbonate of copper. *Bannat.*

XXXII. *a 2.* Compact and of a pitch colour, on indurated iron ochre. *Lauterberg.*

XXXIII. *a 3.* The same, of a dark brown colour, with ochry arborefcient native copper on the surface. *Breidenbach, Cologne.*

XXXIV. *a 4.* The same, of a blackish colour, intermixed with grey and green copper ore. *Saxony.*

*b.* Pulverulent.

### SPECIES IV. CARBONATE OF COPPER.

*Green and Azure Copper Ore. Mine de cuivre verte ou azurée, Fr. Kupferlazur, Kupfergrun, Germ.*

This, which is by many divided into two species, occurs either in earthy lumps; or intersperfed through, or covering the surface of other minerals; or of particular shapes, as stalactitic, botryoidal, mamillated, &c. or crystallised in rhomboidal octohedrons, or rhomboidal tetrahedral, or in hexhedral prisms with their varieties, or in capillary filaments. Its colour is either grafs, verdigris, or emerald green, or azure, smalt or indigo blue; its lustre for the most part splendid, often silky; texture either earthy, compact or fibrous. The compact (*Malachite*) generally composed of concentric undulating layers, internally radiated and admitting of a fine polish; the earthy, on the contrary, often so soft as to stain the fingers; the crystallised generally brittle and transparent. Specific gravity from 3.5 to 3.994. It dissolves with effervescence in the nitric acid and imparts to it a green colour, and to solution of ammoniac a blue. Under the blow-pipe it blackens without melting, but if urged by an intense heat it yields a metallic globule. With borax it effervesces, communicating

municating to it a yellowish green colour. The silky malachite of *China* yields Copper 75, Carbonic Acid 19.4, Water 5.6; other varieties from 66 to 70 per cent. of Copper. This ore is found at *Helstone* and near the *Land's End* in *Cornwall*, in the south part of *Wales*, at *Moldava* in the *Bannat*, at *Lauterberg* and *Zellerfeld* in the *Hartz*, at *Saalfeld* in *Thuringia*, at *Bulach* in *Wurtemberg*, at *Falkenstein* in *Tyrol*, at *Kamsdorf* and *Freyberg* in *Saxony*, at *Mezana Gora* in *Poland*, at *Schmolnitz*, *Neusol*, and other parts of *Hungary*, in *Siberia* particularly in the northern parts of the *Ural*, at *Kupferberg* in *Silesia*, as also in *Russia*, *Norway*, *Hesse*, the duchy of *Deux Ponts*, and many other places.

The *Red Copper Ore*, on the authority of *Baron Born*, introduced at first as a variety of Carbonate of Copper, (*Cuivre regulin combiné avec l'acide carbonique Catal. de Raab. T. 2. P. 323,*) has by subsequent experiment proved to be an oxide.

#### VARIETY I. CRYSTALLISED.

a. In rhomboidal octohedrons and their varieties.

XXXV. b 1. In brilliant rhomboidal tetrahedral prisms obliquely truncated at their extremities, of a deep azure blue colour, arranged in a stellated form on grey copper mixed with blue and green copper ore and quartz.

*Bulach.*

*R. de L. Espece 61b, Var. 1st.*

XXXVI. b 2. The same, also of a blue colour with green velvety copper ore, on the surface of a solid irregular mass of red copper ore.

*Bannat.*

c. In hexhedral prisms.

XXXVII. d 1. Indeterminate, and of an indigo blue colour, forming small tubercles disposed in the cavities of hepatic copper ore, having green carbonate of copper on the surface.

*Bulach.*

XXXVIII. d 2. The same, in minute crystals with green copper ore, in cavernous ochry quartz.

*Bannat.*

XXXIX. d 3. Minutely crystallised, of a Prussian blue colour, on the surface of ochry cavernous quartz mixed with sky blue copper ore.

*Hungary.*

XL. d 4. In delicate short fibres of a dark green colour and velvety appearance, on red granular copper ore.

*North America.*

XLI. d 5. In long silky striæ converging to different centres, of a deep grass green colour, on compact red copper ore.

*Siberia.*

XLII. d 6.

XLII. *d* 6. In short silky fibres of a lighter green colour, on white ponderous spar with indurated iron ochre.

*Annaberg.*

XLIII. *d* 7. Of a fibrous structure and mamillated externally, of a deep grass green colour, on cellular ferruginous quartz, with transparent crystals of white spathose lead ore on the surface.

*Hartz.*

XLIV. *d* 8. In small detached crystalline fragments of a dark blue colour.

*Siberia.*

## VARIETY II. OF PARTICULAR SHAPES.

XLV. *a* 1. In long solid cylinders, adhering in a parallel direction and projecting from a cavernous mass of ochry green carbonate of copper, the cavities of which and the cylinders on one side are covered by minute and brilliant crystals of blue copper ore.

*Catal. de Raab. 12. F. b. 3.*

*Bannat.*

XLVI. *a* 2. In numerous pyramidal perforated stalactites, of a light green colour and radiated texture internally, with a brownish coating.

*Kamisdorf.*

XLVII. *a* 3. In a very irregular mass, composed of short contorted stalactites of a light green colour inclining to white on the surface, with red copper ore and white crystallised quartz.

XLVIII. *b* 1. Forming large aggregated tubercles, having a botryoidal appearance, internally of a green colour and covered on the surface with yellowish white clay.

*Middleton Tiers, Yorkshire.*

XLIX. *b* 2. Of a vitreous texture and dull green colour, forming small botryoidal ramifications on yellow copper ore.

*Siberia.*

L. *b* 3. Of an indurated texture and bright green colour, affording a superficial botryoidal coating to yellow copper ore.

*Ludgvan.*

LI. *b* 4. In small tubercles partly aggregated, of a bluish colour with green carbonate of copper, on an ash-coloured sandstone.

*Molina, Spain.*

LII. *c* 1. Of a green colour and compact texture, having a mamillated surface of a brown colour.

*Siberia.*

LIII. *c* 2. The same, cut and polished.

*Same place.*

A a

LIV. *c* 3.

- LIV. c 3. The same, in more aggregated tubercles. *Hungary.*
- LV. c 4. In very long silky diverging fibres, compact and mamillated on the surface, attached to reddish ochry copper ore with crystallised quartz. *Saxony?*
- LVI. c 5. An irregular mass of green copper ore intermixed with red copper ore, having a green velvety mamillated surface. *Carnarvonshire.*
- LVII. c 6. Mamillated green copper ore of a compact texture, intermixed with copper ore of a prussian and indigo blue colour. *Molina, Spain.*
- LVIII. c 7. The same, of a pale green colour and irregular on the surface, the paleness of the colour depending on an admixture of clay. *Cornwall.*
- LIX. c 8. In an irregular indurated mass composed of diverging fibres. *Siberia.*
- LX. c 9. The same, of a lighter colour, on ochry ponderous spar. *Annaberg.*

## VARIETY III. AMORPHOUS.

- LXI. a 1. An irregular piece, composed of layers of a fibrous texture and brown colour intermixed with green, *Cbina.*
- LXII. b 1. Of an earthy texture, light and of a pale green colour, (*Viride montanum.*) *Hungary.*
- LXIII. b 2. Of a pale green colour, and indurated, cut and polished. *Molina, Spain.*
- LXIV. b 3. In loose pieces of a deeper green colour. *Walckenried.*
- LXV. b 4. Of a light green colour, covering the surface of a layer of yellow copper ore, on plated baroselenite. *Alva, Scotland.*
- LXVI. b 5. Of an indigo blue colour, lying superficially on grey copper ore with ochry indurated clay. *Marienberg.*
- LXVII. b 6. Of an earthy texture and smalt blue colour, with light green copper ore, on white opaque ponderous spar. *Matlock, Derbyshire.*
- LXVIII. b 7. Blue and green carbonates of copper, superficial, on white plated ponderous spar. *Saalfeld.*
- LXIX. b 8.



LXIX. *b* 8. Of a light green colour and earthy, on the surface of crystallised yellow copper ore with galena and ochry quartz. *Hartz.*

LXX. *b* 9. Of a light green colour, impregnating pieces of argillaceous schistus.

LXXI. *b* 10. Of a light green colour, penetrating the substance of a piece of animal bone. *Denbyshire.*

## SPECIES V. ARSENIATE OF COPPER.

*Oxide de Cuivre combiné avec L'Acid arsenique, Fr. Olivenerz, Germ.*

This combination of copper with the acid of arsenic is seldom found in any other than a crystallised form, and then either in small transparent cubes, or in lengthened tetrahedral or compressed hexhedral prisms longitudinally striated, or more frequently in slender capillary crystals often decussating each other, or aggregated into fasciculi, or assuming the appearance of moss. Its colour varies from blackish or dark olive green to that of verdigris. Its surface splendid; fracture apparently foliated. It is brittle, yields easily to the knife, and gives a straw yellow or deeper olive green streak. Specific gravity according to *Delametherie* 3.8. Under the blow-pipe the capillary crystals detonate, give out a strong arsenical smoke and melt into a grey globule, that fluxed with borax yields a pure regulus; while the cubic crystals tumify without decrepitation, afford less vapour and yield to borax a globule, which though malleable is of a paler colour, and, according to the analysis of *Mr. Klaproth*, contains a small proportion of Iron.

This ore has hitherto been found principally at *Carrarack* in *Cornwall* in cellular ferruginous quartz or brown iron stone, and is often accompanied with malachite and other copper ores, and also, as it is said, with uranite. *Gerhard* states it as occurring likewise at *Fonsback* near *Rudelsstadt* in *Silesia*.

## VARIETY I. CRYSTALLISED.

LXXII. *a* 1. In small lengthened tetrahedral prisms of a dark olive green colour, variously interwoven, on the surface of white ochry opaque quartz. *Cornwall.*

LXXIII. *a* 2. The same more closely aggregated, on the surface of ochry quartz intermixed with light green carbonate of copper. *Same place.*

LXXIV. *a* 3. The same in shorter prisms, arranged in diverging fasciculi, in cellular ochry quartz. *Same place.*

A a 2

LXXV. *b* 1.

LXXV. *b* 1. In small cubes of an emerald green colour, numerously aggregated on brown feldspar. *Same place.*

LXXVI. *c* 1. In delicate transparent hexagonal tables, of a bright emerald green colour, lining cavities in indurated red calciform copper ore with quartz. *Same place.*

LXXVII. *d* 1. In minute indeterminate crystals of an olive green colour, on the surface of and diffeminated through spongy ferruginous quartz. *Same place.*

LXXVIII. *d* 2. The same intermixed with green carbonate of copper. *Same place.*

#### SPECIES VI. SULPHATE OF COPPER.

*Viatriol de Cuivre*, Fr. *Kupfer-Viatriol*, Germ.

This, though generally met with in a state of solution in what are called *Cupreous* springs, occurs sometimes concrete, and when pure forms transparent tetrahedral crystals of a deep blue colour and strongly styptic taste; soluble in about four times their weight of water, and by exposure to the air losing their lustre and becoming covered with a greyish efflorescence. They are however, for the most part, contaminated with sulphate of iron or of zinc, and sometimes with both. By analysis a hundred parts of the pure sulphate contains nearly of Oxyde of Copper 35, Sulphuric Acid 27.68, Water of Crystallisation 28. In solution it gives a beautiful blue colour on the addition of ammoniac, and yields its copper in the metallic state to polished iron. In the concrete form it is found in many places, as in *Siberia*, *Norway*, *Sweden*, *France*, *Hungary*, &c. In solution the more remarkable instances with us are, those of *Paris Mine* in the *Isle of Anglesea*, and of *Wicklow* in *Ireland*.

#### VARIETY I. CRYSTALLISED.

LXXIX. *a* 1. In small rhomboidal parallelepipeds of a blue colour, on yellow copper ore.

*R. de L. Pl. 4, Fig. 71.*

LXXX. *b* 1. In flatted rhomboidal crystals of the same colour, in indurated blue carbonate of copper. *Norway.*

LXXXI. *b* 2. In a minutely crystallised incrustation on opaque muriate of Soda. *Hungary.*

LXXXII. *b* 3. In a mass, irregularly cellular on one side, on the other indeterminedly crystallised, with yellow copper pyrites. *Goflar.*

LXXXIII. *b* 3.

LXXXIII. *b* 4. Black argillaceous schistus impregnated with sulphate of copper, partly in the form of an efflorescence and partly in minute crystals. *Yorkshire.*

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Stalactitic.

## VARIETY III. IN SOLUTION.

### SPECIES VII. MURIATE OF COPPER.

*Green Sand of Peru.*

Brought from *Peru* by *Mr. Dombey* in shining semitransparent particles of a beautiful emerald or grass green colour. Specific gravity according to *Delametherie* 3.78. On distillation with the sulphuric acid it yields a certain quantity of muriatic acid, in which as well as in the nitric it is soluble without effervescence, communicating to the first a blue, to the latter a green colour; it is also soluble in the aqueous solution of ammoniac. Projected on burning coals or under the blow-pipe it communicates a greenish or bluish flame, and by the latter fuses into a bluish glass.

## VARIETY I. AMORPHOUS.

LXXXIV. *a* 1. In a sandy form and of a bright emerald green colour. *Peru.*

### SPECIES VIII. SUPHURET OF COPPER.

*Vitreous Copper Ore. Cuivre Sulphuré, Fr. Kupferglas, Kupferglanz, Schwarzes-Kupfererz, Germ.*

This is of a lead grey colour, inclining often to iron black, and sometimes to yellow or red. It is met with either in lumps, interspersed or superficial, and not unfrequently crystallised in hexedral truncated prisms, and also, as it is said, in cubes and octohedrons. Often both internally and externally of a metallic splendour, and always opaque. Its fracture compact or foliated. It is soft, sometimes semimalleable, and often cuts easily with the knife; becomes more splendid by the streak; specific gravity from 4.129 to 5.66. It effervesces with and communicates a green colour to nitric acid, to solution of ammoniac a blue. Under the blow-pipe it fuses very easily and tinges borax of an emerald green colour. According to *Klaproth* the vitreous ore of *Trezeven* in *Cornwall* contains  $56\frac{1}{2}$  per cent. of copper. This combination of copper and sulphur is found in various parts of the world, as at *Frolowskoi* in *Siberia*, *Bottendorf* and *Eisleben* in *Thuringia*, *Freyberg* in *Saxony*, *Sajka* in the *Bannat*, in *Scotland*, and in many of the mines of *Cornwall*.

## VARIETY

VARIETY I. *CRYSTALLISED.*

LXXXV. *a* 1. In hexedral prisms truncated at their extremities and iridescent on the surface, very slender, attached to each other irregularly, and lying on botryoidal yellow copper ore. *Cornwall.*

LXXXVI. *a* 2. In small and shorter prisms, on the surface of compact sulphuret of copper with yellow pyrites, forming a vein in reddish granite. *Same place.*

LXXXVII. *a* 3. In numerous short prisms of a lamellated texture and lead grey colour, aggregated confusedly on grey ochry quartz intermixed with the same. *Same place.*

LXXXVIII. *a* 4. In larger aggregated crystals of the same colour, on compact ore of the same, intermixed with quartz and covered on the surface with ochry red copper ore. *Same place.*

VARIETY II. *AMORPHOUS.*

LXXXIX. *a* 1. Of a close granular texture and leaden grey colour, with friable quartz and green carbonate of copper on the surface. *Same place.*

XC. *b* 1. Of a foliated texture and reddish grey colour, with green calx of copper and whitish indurated clay. *Saxony.*

XCI. *c* 1. Compact, of a steel grey colour with yellow pyrites and quartz. *Cornwall.*

XCII. *c* 2. The same, in an irregular piece of a dark grey colour, without matrix. *Same place.*

XCIII. *c* 3. The same, of a steel grey colour with ash-coloured micaceous clay. *Bannat.*

XCIV. *c* 4. The same, intermixed with ochry red oxyde of copper. *Cornwall.*

SPECIES IX. *VARIEGATED COPPER ORE.*

*Mine de Cuivre violette ou azurée, Fr. Bunt-Kupfererz, Bunt-Kupferglas, Germ.*

This differs from the foregoing in containing a small proportion of iron. It occurs either in masses, interspersed, superficial, and, according to the opinion of some, crystallised

lified in octohedrons. Its colour, when fresh broken, is intermediate between copper red and tombac brown, changing, according to length of exposure, into dark red, violet, sky-blue and green. It is always opaque; has more or less of a metallic lustre; fracture conchoidal; yields to the knife and gives a splendid red streak; specific gravity about 4.95. Like the former it dissolves with effervescence in the nitric acid, imparting to it a green colour, but does not so immediately communicate a blue colour to solution of ammoniac. Under the blow-pipe it also melts easily and tinges borax green. It yields from 40 to 60 per cent. of Copper. It is found, generally accompanied with other copper ores, in the mines of *Norway*, *Sweden*, and *Siberia*, of the *Bannat*, *Saxony*, *Thuringia*, *Cornwall*, &c. &c.

#### VARIETY I. CRYSTALLISED?

a. In octohedrons.

#### VARIETY II. AMORPHOUS.

XCV. a 1. Compact, of a dark grey colour, interspersed through black indurated schistus. *Ilmenau.*

XCVI. a 2. The same, but without matrix. *Kamisdorf.*

XCVII. a 3. The same, with white quartz. *Cornwall.*

#### SPECIES X. YELLOW COPPER ORE.

*Pyrite de Cuivre*, Fr. *Kupferkies*, Germ.

In this there is a larger proportion both of iron and of sulphur than in the variegated ore. Its colour when recently dug or fractured is brass yellow of different shades, inclining sometimes to steel grey. By exposure to air it becomes tarnished or variegated. It is found either in veins or lumps, interspersed, superficial, more rarely of particular shapes; and very frequently crystallised in equilateral tetrahedrons or in dodecahedrons with triangular faces and their modifications. The surface of the crystals is commonly smooth and of a metallic splendour; fracture uneven or conchoidal; hardness nearly the same with the preceding; specific gravity from 3.8 to 4.31. It dissolves in the nitric acid without effervescence, and yields a reddish brown precipitate on the addition of ammoniac. Before the blow-pipe it decrepitates, emits a greenish sulphureous smoke, and melts into a black mass, which communicates a green tinge to glass of borax. It varies in the proportion of Copper from 4 to 20, or as some say to 30 per cent. The harder it is, the larger is its proportion of Iron. The universality of this ore is such, that where mining has been carried to any extent it has seldom failed to occur.

## VARIETY I. CRYSTALLISED.

XCVIII. *a* 1. In large aggregated equilateral tetrahedrons, iridescent and of a velvety appearance on the surface, on prismatic ochry quartz. *Cornwall.*

*Catal. de Raab* 12. C. b. 1.

XCIX. *a* 2. In smaller tetrahedrons implanted one on the other so as to form aggregated columns, covered on the surface by green carbonate of copper and yellow ochre. *Lorraine.*

C. *a* 3. In tetrahedrons forming irregular aggregated trihedral pyramids, iridescent, on an amorphous mass of yellow copper ore. *Hungary.*

*b*. In dodecahedrons with triangular faces.

*R. de L. Pl.* 1, *Fig.* 9.

CI. *c* 1. In numerous cubes of different sizes, variously truncated, striated on the surface and of a bright gold colour on white crystallised quartz. *Same place.*

CII. *d* 1. In aggregated octohedrons of a duller colour, with lenticular calcareous spar on flesh coloured baroselenite. *Freyberg.*

CIII. *d* 2. The same, in crystals less distinct, of a bronze yellow colour, on opaque baroselenite. *Hartz.*

CIV. *e* 1. In pyramidal crystals united into an irregular cluster, variegated on the surface, on transparent crystallised quartz with galena and pearl spar. *Furstenberg.*

CV. *e* 2. In large crystals, confusedly aggregated, iridescent on the surface, and enclosing a large octohedral crystal of yellow iron pyrites. *Germany.*

CVI. *e* 3. In small brilliant crystals of a sky blue colour on the surface, with minutely crystallised transparent calcareous spar, on ash-coloured lime-stone.

*Ellon Mine, Staffordshire.*

CVII. *e* 4. The same, partly blue and partly yellow, numerously aggregated on tuberculated opaque baroselenite. *Same place.*

CVIII. *e* 5. In minutely aggregated crystals, variegated in colour, in the clefts of whitish indurated clay. *Alsace.*

CIX. *e* 6.

CIX. *a* 6. In a mass composed of very irregular crystals with a dull greenish efflorescence on the surface, intermixed with white pearl spar. *Newstadt.*

VARIETY II. OF PARTICULAR SHAPES.

CX. *a* 1. In aggregated tubercles of a bluish colour and without lustre, producing a botryoidal appearance on the surface of amorphous yellow copper ore. *Cornwall.*

CXI. *a* 2. In brilliant tubercles with white calcareous spar. *Eaton Mine, Staffordshire.*

CXII. *b* 1. Of a knitted appearance. *Cornwall.*

VARIETY III. AMORPHOUS.

CXIII. *a* 1. Of a granular texture intimately intermixed with galena. *Catharinaberg, Siberia.*

This mineral is said to be scarce, and is highly phosphorescent.

CXIV. *a* 2. In coarse grains variegated in colour, forming minute ramifications through white opaque pearl spar. *Hartz.*

CXV. *b* 1. Compact, of a purple and shining green colour, like that of the *Cantbaris* or Spanish fly, ramifying in and intermixed with white opaque pearl spar, with grey indurated schist. *Kamisdorf.*

CXVI. *b* 2. In an irregular mass covered with an ochry efflorescence. *Same place.*

CXVII. *b* 3. Compact and iridescent on the surface, with milk white semitransparent opal. *Reskeir, Cornwall.*

CXVIII. *b* 4. The same, intermixed with yellow iron pyrites and white quartz. *Schalback.*

CXIX. *b* 5. The same, less iridescent. *Hartz.*

CXX. *b* 6. Compact, in light green fibrous asbestos. *Bannat.*

CXXI. *b* 7. The same, in green semitransparent fluor. *Cornwall.*

CXXII. *b* 8. The same, with brown indurated ochre, green silky carbonate of copper and crystallised quartz. *Saxony.*

CXXIII. *b* 9. In a compact mass, very brilliant in its fracture and highly iridescent on the surface. *Bamat.*

CXXIV. *b* 10. The same, variegated in colour, having on its surface minute stalactites of a dark blue colour. *Cornwall.*

### SPECIES XI. GREY COPPER ORE.

*Cuivre gris*, Fr. *Fabierz*, Germ.

The ore generally comprehended under this denomination, is of a steel grey colour, often approaching to iron black or lead grey, and not unfrequently variegated on the surface. It occurs either in lumps, interspersed, more rarely superficial, and frequently crystallised in tetrahedrons or dodecahedrons with triangular faces and their modifications. It is generally of a bright metallic splendour, very brittle, not easily scratched by the knife, exhibiting a blackish or brownish black streak. Its texture compact; fracture more or less uneven or inclining to the conchoidal; specific gravity nearly 4. Under the blow-pipe it decrepitates, emits an inodorous white smoke and melts into a dark grey globule, which is brittle, and though infusible with borax, tinges it of a yellowish or brownish red colour. The different analyses of this ore shew it to vary considerably with respect to its composition. According to the experiments of *Klaproth* one from *Andersberg* in the *Hartz*, which has been considered as the true *Fabierz*, contained Copper 16.25, Grey Antimonial Ore 16, Iron 13.75, Lead 34.50, Silver 2.25, Sulphur 10, Silica 2.50; one from *Kremnitz*, Copper 31.36, Grey Antimonial Ore 34.09, Iron 3.30, Silver 14.77, Sulphur 11.50, Alumina 0.30; and one from *Cornwall*, Copper 13.5, Antimony 21, Iron 1.5, Lead 49, Sulphur 7, Silica 0.5. By *Mr. Kirwan* and others the presence of Lead and of Silver is considered as accidental. Grey ore or *Fabierz* is found as well in primitive as in alluvial mountains, and is often accompanied with copper or iron pyrites, blende, galena, and various other mineral substances, in the mines of *Germany*, *Hungary*, *Norway*, *Sweden*, *Siberia*, &c. &c.

### VARIETY I. CRYSTALLISED.

CXXV. *a* 1. In a large tetrahedron, in transparent crystallised quartz, with white pearl spar on the surface. The sides of this crystal measure an inch and a half, and from the external surface is a projection of the solid angle of another crystal.

*R. de L. Cuivre, Espece 3d. Pl. 1, Fig. 1 & 38.*

*St. Marie aux Mines.*

CXXVI. *a* 2. In tetrahedral crystals irregularly aggregated, with transparent crystallised quartz and yellow iron pyrites. *Hungary.*

CXXVII. *a* 3.



CXXXVII. *a* 3. The same in larger crystals, with white crystallised quartz, on grey schistus. *Hartz.*

CXXXVIII. *a* 4. In small regular tetrahedrons, interspersed through whitish indurated clay. *Obermoschbell.*

CXXXIX. *a* 5. The same, imbedded in greyish black argillaceous schistus.

CXXX. *a* 6. In tetrahedrons, some distinctly bevelled at their edges (*R. de L. Pl. 1, Fig. 17.*) others more or less rounded, some solitary, others aggregated, and all covered on the surface with an iridescent pyritical incrustation, with dull whitish crystallised pearl spar and crystallised galena, on grey wacke. *Hartz?*

CXXXI. *b* 1. In small dodecahedrons, formed from the elevation of an obtuse trihedral pyramid on each face of the tetrahedron, with ramose native silver and crystallised calcareous spar, on a mixed mass of grey copper and calcareous spar. *Same place?*

CXXXII. *c* 1. In an irregular cellular mass, having many of the cells filled with lumps of testaceous arsenic and covered with an ash-coloured calx. *St. Marie aux Mines.*

## VARIETY II. AMORPHOUS.

CXXXIII. *a* 1. Of a dark grey colour, compact and without matrix. *Kongberg.*

CXXXIV. *a* 2. Of a leaden colour and somewhat granulated texture, with spongy opaque quartz and green carbonate of copper on the surface.

*Nassau Dillenburg.*

CXXXV. *a* 3. Of a more compact texture, on one side specular and on the other covered by ash-coloured indurated clay. *Biber, Nassau.*

CXXXVI. *a* 4. The same, covered by dark brown ochre of iron. *Hungary.*  
This by some is called *White Copper* and is said to be very scarce.

CXXXVII. *a* 5. Compact, with reddish feldspar intermixed with yellow copper ore. *St. Bell, Lyons.*

CXXXVIII. *a* 6. Very compact, in black argillaceous schistus. *Biber, Hesse.*

CXXXIX. *a* 7. Impregnating ash-coloured schistus bearing vegetable impressions on the surface. *Frankenberg, Hesse.*

CXL. *a* 8. Impregnating grey argillaceous schistus, resembling fir cones and ears of corn. (*Frankenberger* or *Hessischen Kornähren*.) *Same place.*

CXLI. *a* 9. Intermixed with common coal. *Same place.*

## SPECIES XII. WHITE COPPER ORE.

*Cuivre Blanche*, Fr. *Weiss-Kupfererz*, Germ.

This rare ore of copper is described as being of a silver white colour, inclining to tin white or brassy yellow. It is found only in lumps and interspersed. Its internal splendour is slightly metallic; texture granular, sometimes foliated; fracture uneven; sometimes of sufficient hardness to give fire with steel; brittle, and of considerable weight. Before the blow-pipe it gives out an arsenical smoke and melts into a greyish black slag. According to *Henkel* it contains Copper 40, in combination with Arsenic and Iron, and is therefore considered as intermediate between *Fahlerz* and *Copper Pyrites*, with both of which it is very frequently accompanied. It has been found principally near *Freyberg* in *Saxony*, *Frankenberg* in *Hesse*, *Catharinaberg* in *Siberia*, and at *Freudenstadt* in *Wurtemberg*.

## VARIETY I. AMORPHOUS.

CXLII. *a* 1. Of a compact texture, covered by greenish amianthus. *Saxony.*

## NOTE,

That under the foregoing species are comprehended,

1. Black copper ore (*Kupferschwärze*) resulting from the decomposition of *Fahlerz* or of copper pyrites.
2. Hepatic copper ore (*Kupferlebererz*, *Leberschlag*) a variety of the tile ore.
3. Bituminous copper ore (*Kupferbranderz*) copper pyrites intermixed with coal or other bituminous substances.
4. Brass ore (*Messingerz*) a mixture of copper pyrites and blende.
5. Bell metal ore (*Glockenerz*) copper pyrites with oxyde of tin.
6. Slaty copper ore (*Kupferschiefer*) copper pyrites contained in bituminous slate.
7. Sandy copper ore (*Kupfersanderz*) ores of copper intermixed with sand stone.
8. Turquoise (*Türkis*) the tooth of an animal impregnated with carbonate of copper. Vide *Emmerling's Lehrbuch der Mineralogie*, Vol. II. Pag. 244, 268, &c. vel *Widenmann's Handbuch*, § 269 et 280.

## GENUS

## GENUS VII. IRON.

*Ferrum.* Fer, Fr. *Eisen*, Germ.

Crude iron, when freed from its impurities by exposure to the combined action of heat and air, and subsequent hammering and rolling, is of a bluish white colour, hard, elastic, sonorous, ductile, tenacious, magnetical and susceptible of a fine polish. Its specific gravity 7.788. Its hardness and elasticity are greater than those of any other metal, and next to gold it is the most tenacious, a wire of  $\frac{1}{8}$  of an inch supporting a weight of 450 pounds. It rusts more easily than most other metals on exposure to moisture, and when heated in the open fire undergoes various changes of colour, from superficial oxydation, long before it is ignited, but is extremely difficult of fusion; in a white heat however it becomes so soft that different portions of it may be united into one mass by the operation of *Welding*. Iron is the only metal capable of combustion by collision. If exposed when ignited to oxygen gas it burns with great brilliancy and rapidity, and is converted into a grey oxyde. It is also under ignition very readily oxydated by the vapour of water. By cementation with charcoal it is converted into steel, becoming fusible, more brittle and elastic, and capable when heated and suddenly cooled of contracting extraordinary degrees of hardness. It dissolves more or less perfectly in all the acids; with the sulphuric acid it forms a crystallisable salt of a sea-green colour (*Green Vitriol*), with the prussian acid, common *Prussian Blue*; and with the vegetable astringent principle or acid of galls, the basis of *Common Ink*. From most of its acid solutions it separates on exposure to the air in the form of an ochry precipitate. When oxydated it combines by fusion with both the fixed alkalis as well as with several of the earths, and according to its degree of oxydation communicates different tinges to glass. It may be united with all the other metals in different proportions with the exception of quicksilver, lead, and bismuth. With arsenic it produces a compound, which has received the name of *red short* iron from its being brittle when heated; whilst by union with phosphorus or its acid it acquires the opposite property, and is therefore called *cold short* iron. Of all the metallic substances iron has the strongest attraction for and unites the most readily with sulphur. Bar iron, crude iron, and steel, according to the general opinion, vary from each other principally in containing different proportions of oxygen and carbon. The uses of iron in these forms are too extensive to be enumerated. Its ores, which are more general and abundant than those of any other metal, are,

## SPECIES.

## SPECIES I. NATIVE IRON.

*Fer natif*, Fr. *Gediegen-Eisen*, Germ.

Is internally of a light steel grey colour approaching to silver white, externally yellowish brown, or greyish black. It is found in irregular lumps generally rudely ramose or angular; its fracture hackly, becoming more splendid by the streak; malleable and ductile; of a metallic splendour; specific gravity between 7 & 8. Its chemical properties are similar to those of common iron.

Native iron has been found in the mountain of *Grand Gilbert* in *Upper Dauphiné*, at *Great Kamsdorf* and *Eibenstein* in *Saxony*, and according to some at *Senegal* in *Africa*, but the most remarkable examples are those of *Otumpa* in the diocese of *St. Jago del Estero* in *Peru*, and near the river *Jenesai* in the south of *Siberia*. Of the first of which we have an account by *Don Rubin de Celis*, *Phil. Trans.* 1788; of the latter by Professor *Pallas*, to whom we are indebted for its discovery.

## VARIETY I. OF PARTICULAR SHAPES.

I. a 1. In an irregular solid mass with numerous contorted branches projecting from the surface, the cavities of which are partly filled by a yellow transparent vitrified matter taken generally for crysolite.

*Mont Emor, Siberia.*

II. a 2. In a smaller mass having also projecting branches, but without crysolite.

*Senegal.*

This a portion of a larger mass sent some years since by *Governor O'Hara* to *General Rainsford*.

## VARIETY II. AMORPHOUS.

III. a 1. In a compact irregular mass.

*Kamsdorf.*

## SPECIES II. GREY IRON ORE.

Under this species are included such ores of iron as in their colour, lustre, specific gravity, and disposition to obey the magnet, are the most nearly allied to the foregoing, viz. the *Magnetic Iron ore* as it is called, and *Iron sand*, *Specular Iron Ore*, *Micaceous Iron Ore*, &c.

The magnetic ore (*Fer noir*, Fr. *Magnetischer-Eisenstein*, Germ.) is of a blackish or bluish grey colour internally, often brownish black on the surface. It occurs either in  
the

the mass, or disseminated, and not unfrequently crystallised. Its fracture fine or coarse grained, inclining sometimes to conchoidal, sometimes imperfectly foliated; lustre metallic; opaque; of sufficient hardness to give fire with steel; brittle. Its crystals seldom large, often solitary and covered with a talcose incrustation; their figure the octohedron and its modifications. Specific gravity from 4.094 to 4.688.

From this the iron sand differs only in form, being no other than comminuted portions collected in the beds of rivers, and therefore generally accompanied with native gold.

The specular ore (*Fer Speculaire*, Fr. *Eisglanz*, Germ.) is of a light or dark steel grey colour, inclining sometimes to blue, red or black, and often beautifully variegated on the surface. It is found in strata or in lumps, interspersed, superficial, and frequently also crystallised in modifications of the cube, in double hexhedral pyramids deeply truncated at the summits, and in hexhedral laminæ. It is of a metallic lustre; opaque; its fracture fine or coarse grained and uneven; hardness nearly the same with the foregoing; gives a greyish or dark red streak; specific gravity from 4.939 to 5.218.

The magnetic iron ore and iron sand are both strongly attracted by the magnet, which in its native state is indeed only a variety of this ore and generally such as has been exposed to the influence of the atmosphere. The specular ore on the contrary seldom possesses this property, at least in any considerable degree. Both the magnetic and specular ores are more readily acted on by the muriatic than by either the sulphuric or the nitric acid, by which without the assistance of heat they are slightly, if at all affected. Before the blow-pipe the magnetic ore becomes brown and communicates a dark green colour to glass of borax. By means of oxygen gas it is easily fused and runs into a black globule. The specular ore is more difficult of fusion, reddens under torrefaction, and tinges borax of a dull yellow. In these ores the metal is considered as being partially oxydated, the magnetic yielding from 80 to 90, the specular from 60 to 80 per cent. Iron, the product of the first, being according to *Rinman* brittle when hot, but losing this property after a second fusion. They are found in great abundance in *Siberia*, *Norway*, and *Sweden*, where they sometimes constitute entire mountains; in different parts of *Saxony*, *France*, and *Italy*; in *Virginia*, *Peru*, *St. Domingo*, *Coast of Africa*, and various other parts of the world.

The micaceous iron ore (*Eisenman*, Germ.) is of an iron black colour inclining sometimes to the steel grey, sometimes to the red. It is found in lumps, interspersed, superficial, or in thin plates or tablets, with a smooth and splendid surface and faintly transparent; is semi-indurated; stains the fingers, and gives a dark red streak. Before the blow-pipe it exhibits nearly the same characters as the specular iron ore. This is found in many parts of *Saxony*, *Hungary*, *Upper Palatinate*, *Baireuth*, &c.

## VARIETY

VARIETY I. *CRYSTALLISED.*

IV. *a* 1. In detached octohedrons of different sizes, some regular, some cuneiform, others having two opposite and parallel faces truncated to a certain depth and more inclining to the rhomboidal paralleloepid. *Fahlun in Sweden, also from Corsica.*

*R. de L. Pl. 3, Fig. 1, 2, 9, 12.*

The larger crystals, which are from *Sweden*, have a coating of dark green talc.

V. *a* 2. In numerous small octohedrons, imbedded in dark green steatite. *Corsica.*

VI. *a* 3. In octohedrons which pass into the dodecahedron by the application of triangular lamellæ regularly decreasing, with greyish indurated clay, on compact grey iron ore. *Sweden.*

*R. de L. Pl. 4, Fig. 69.*

VII. *b* 1. In numerous small smooth cubes, imbedded in green fluor, in coarse ferruginous quartz. *Altenberg.*

VIII. *b* 2. The same, covering the surface of prismatic semitransparent quartz.

*Alsace.*

IX. *b* 3. In cubes, some perfect, others variously truncated, in the cavities of ferruginous quartz. *Altenberg.*

X. *b* 4. In an irregular mass variegated on the surface, chiefly composed of flattened dodecahedral crystals made up of irregular pentagons, six of which are smooth and six striated parallel to their base. *Isle of Elba.*

*R. de L. Pl. 2, Fig. 30.*

XI. *b* 5. The same, but with more brilliant superficial colours. *Same place.*

XII. *b* 6. The same, in more flattened dodecahedrons, six faces of which are striated pentagons, the others smooth and triangular. *Same place.*

*R. de L. Pl. 2, Fig. 36.*

XIII. *b* 7. The same, of a remarkably bright high-gold colour on the surface and interspersed with white prismatic quartz and yellowish rhombic crystals of felspar.

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*Same place.*

XIV. *b* 8.

XIV. *b* 8. In thin lenticular crystals, imbedded edgeways in prismatic crystallised quartz. *Altenberg.*

*R. de L. Pl. 2, Fig. 36.*

XV. *b* 9. In splendid lenticular crystals composed of 24 irregular pentagonal faces, 6 striated and 18 smooth, on grey ferruginous clay. *Same place.*

*R. de L. Pl. 2, Fig. 39.*

XVI. *b* 10. The same, in larger crystals without matrix. *Same place.*

XVII. *b* 11. In very flat lenticular crystals, of a dull purplish colour and splendid, with quartz and white clay. *Same place.*

XVIII. *b* 12. In crystals less flattened, having on the surface the blue lustre of heated polished steel, with quartz and white clay. *Same place.*

XIX. *b* 13. In smaller aggregated crystals. *Same place.*

XX. *c* 1. In double hexedral pyramids deeply truncated at their summits with short intermediate prisms closely aggregated, of a grey colour externally and variegated within.

*R. de L. Pl. 6, Fig. 44. Same place.*

XXI. *c* 2. The same, in minute crystals without prisms, covering the surface of prismatic quartz, with ferruginous indurated clay. *Same place.*

*R. de L. Pl. 6, Fig. 7.*

XXII. *d* 1. In thin hexagonal laminæ on each side bevelled at the edges, implanted in the cavities of granular grey iron ore. *Lorraine.*

*R. de L. Pl. 6, Fig. 44.*

XXIII. *d* 2. The same aggregated into crystals, and from their projecting edges producing a striated appearance on the surface. *St. Marie aux Mines.*

XXIV. *e* 1. In indeterminate polyhedral crystals of a lamp black colour. *Elba.*

XXV. *e* 2. In small brilliant crystals covering the surface of grey iron ore *Hungary.*

XXVI. *e* 3. In indeterminate polyhedral crystals, imbedded in variegated grey iron ore of a fine scaly texture. *Norberg, in Dalurue, Sweden.*

XXVII. *e* 4. The same, implanted in ash-coloured indurated clay. *Altenberg.*

VARIETY II. AMORPHOUS.

XXVIII. *a* 1. Composed of large thin shining folia, diverging and by their projection at the surface producing a cockscomb appearance. *Osnaburg.*

XXIX. *a* 2. ——— of smaller shining laminæ, diverging and friable. *Siberia.*

XXX. *a* 3. ——— of thin splendid irregularly conchoidal laminæ, in reddish quartz. *Northumberland.*

XXXI. *a* 4. ——— of thin stellated lamellæ of a steel grey colour, in greyish ferruginous quartz. *Sweden.*

XXXII. *a* 5. Of a dark steel grey colour, and foliaceous texture, giving it a feather-like appearance. *Siberia.*

XXXIII. *a* 6. Of a lamellated texture, and blackish grey colour, with a small vein of grey quartz. *Norberg.*

The best Swedish steel is obtained from this ore.

XXXIV. *a* 7. Composed of thick lamellæ irregularly aggregated and highly iridescent on the surface. *Elba.*

XXXV. *a* 8. ——— of small thin shining scales loosely cohering. *Devonshire.*  
(*Eisenman.*)

XXXVI. *a* 9. The same, more strongly cohering and inclining to a reddish brown. *Goffenback.*

XXXVII. *b* 1. Of an iron grey colour and granular texture. *Bisberg, Sweden.*

XXXVIII. *b* 2. Of a bluish grey colour and finer texture, with indefinite crystals of grey iron ore interspersed. *Sweden.*

XXXIX. *b* 3. Of a dull iron grey colour and coarse granular texture, having numerous distinct dodecahedral garnets imbedded in it. *Tyrol.*

XL. *b* 4. Of a shining bluish grey colour and shattery angular texture. *New York.*

XLI. *b* 5. Of a steel grey colour and fine grained almost solid texture. *Kerna, Lapland.*

XLII. *c* 1.



- XLII. *c* 1. Of a compact texture and dull grey colour. *Norway.*
- XLIII. *c* 2. Of a compact texture and variegated on the surface, with quartz and yellowish talc. *Altenberg.*
- XLIV. *c* 3. The same, of a liver brown colour, strongly magnetic. *Coast of Africa.*
- XLV. *c* 4. A similar specimen from *Saxony.*
- XLVI. *c* 5. Another of a coarser texture. *Elba.*
- XLVII. *c* 6. Another cut and polished. *Siberia.*
- XLVIII. *d* 1. In loose minute and shining grains (*Iron Sand*). *America.*
- XLIX. *d* 2. The same. *Coast of Africa.*
- L. *d* 3. The same. *Italy.*
- LI. *e* 1. In coarse grains interspersed through quartz. *Turkey.*
- LII. *e* 2. In finer grains of a lighter grey colour. *Same place.*  
(*Emery Stone.*)

### SPECIES III. HEMATITE.

*Hématite, Oxide de Fer endurci, Fr. Glaskopf, Germ.*

This ore, which is usually more or less of a blood red colour, as its name imports, is also not unfrequently of different shades of brown, black, or yellow (*Roib, braun & schwarz Eisenstein, Germ.*) ; its lustre generally approaching to the semi-metallic. It occurs either in veins or beds ; or in amorphous masses ; or of particular shapes, as stalactitical, mammillated, reniform, botryoidal, &c. or interspersed through or forming a covering to other ores ; sometimes semi-indurated, or in loose scales. Its texture in the mass compact or earthy, in detached portions generally fibrous, its fibres often diverging and composed of concentric layers. It is, for the most part, scratched easily by the knife, sometimes soils the fingers, sometimes of sufficient hardness to give fire with steel ; the red gives a black red streak, the brown and black a yellowish brown or ochry yellow. In specific gravity it varies from 3.4 to 5. By the assistance of heat it dissolves though slowly both in the sulphuric and nitric acids, the muriatic acts on it more readily, but without effervescence. It is not attracted by the magnet except when reduced to powder, and then only in a very slight degree ; this property however it acquires by exposure to heat. Under

der the blow-pipe it blackens, but is extremely difficult of fusion. To glass of borax it imparts a yellowish or olive green colour. It yields from 40 to 80 per cent. of Iron, and appears to differ from the foregoing species principally in its greater degree of oxydation, and in containing a small portion of Alumine. It is found in the forms above mentioned, and often accompanied by various other mineral substances in the *Hartz, Saxony, Bobemia, Hungary, Nassau Siegen*, and several other neighbouring countries; but seldom in the more northern. The common red hematite occurs near *Ulverston* in *Lancashire*, from whence it is sent in large quantities to the *Carron* works in *Scotland*.

#### VARIETY I. OF PARTICULAR SHAPES.

LIII. *a* 1. In long parallel cylindrical stalactites adhering to each other laterally, of a dark brown colour and shining, with numerous tuberculæ on the surface. *Nassau Siegen*.

*Catal. de Raab.* 11 F. c. *b.* 11.

LIV. *a* 2. The same, with an ochry incrustation, having the cylinders more irregularly disposed. *Colebrook Dale*.

LV. *a* 3. Of an olive brown colour and somewhat fibrous texture, with numerous subulate stalactites projecting from the surface.

LVI. *a* 4. Of a yellowish brown colour and cellular texture, with numerous short projecting stalactites intermixed with quartz. *Dean Forest, Gloucestershire*.

(*Bruslb Iron ore.*)

LVII. *a* 5. In a flat piece of a dark brown colour with subulate stalactites projecting from both sides. *Nassau Siegen*.

LVIII. *a* 6. In nodular cylindrical stalactites, of a clove brown colour, aggregated laterally and covered on the surface by a splendid bronze-yellow hematitical incrustation.

*Same place.*

LIX. *a* 7. The same, less splendid, in more numerous and smaller cylinders with white ponderous spar. *Same place.*

LX. *a* 8. In subulate stalactites, irregularly aggregated on brown striated hematite, dark and shining on the surface. *Nassau Dillenberg.*

LXI. *a* 9. In cylindrical stalactites of a clove brown colour, curiously interwoven and attached to each other. *Nassau Siegen.*

LXII. *a* 10.

LXII. *a* 10. In an irregular stalactitical mass of a blackish grey colour.

*Nassau Dillenberg.*

LXIII. *a* 11. Of a dark brown colour, irregularly stalactitical and covered by a tile-coloured coating, on ash-coloured indurated clay.

*Nassau Siegen.*

LXIV. *a* 12. In small cylindrical stalactites, of a blackish brown colour, variously contorted, with cellular ochry quartz.

*Same place.*

LXV. *a* 13. In large cylindrical aggregated stalactites, of a radiated structure, dark and shining on the surface and internally of a chocolate colour.

*Bendorf.*

LXVI. *b* 1. In a coarsely grained mass tuberculated on the surface, with a reddish brown velvety covering.

*Lancashire.*

LXVII. *b* 2. The same, in smaller tubercles, having a brighter velvet-like coating.

LXVIII. *b* 3. Of a dark brown colour, shining, and of a mulberry-like appearance on the surface from numerous small globular stalactites.

*Nassau Siegen.*

LXIX. *b* 4. Of a dark clove brown colour and striated texture, with a shining tuberculated surface.

*Norway.*

LXX. *b* 5. Of a reddish brown colour and vermicular form, on the surface of plated ponderous spar.

*Scotland.*

LXXI. *c* 1. Reniform, internally fibrous and radiated.

*Lancashire.*

LXXII. *d* 1. In a stalactitical nodule of a clove brown colour, composed of aggregated tuberculi.

*Germany.*

LXXIII. *e* 1. In an aggregated cellular mass light and friable, partly ash-coloured, partly brown.

*Nassau Siegen.*

LXXIV. *e* 2. Forming a thin variegated incrustation on the surface of cellular quartz.

*Hungary.*

## VARIETY II. AMORPHOUS.

LXXV. *a* 1. Composed of striae regularly diverging and of a reddish brown colour.

*Lancashire.*

LXXVI. *a* 2.

LXXVI. *a* 2. Of a chocolate colour and striated texture, smooth and shining on the surface. *Germany.*

LXXVII. *a* 3. Of a liver brown colour and divergingly striated texture, having strongly the appearance of wood tin. *Schmiedeberg.*

LXXVIII. *b* 1. Of a dark brown colour and scaly texture, having a radiated appearance. *Nassau Siegen.*

LXXIX. *b* 2. The same, in a thinner portion, mammillary and variegated on the surface. *Seine.*

LXXX. *c* 1. Of a reddish brown colour, compact and specular on the surface. *Bobemia.*

LXXXI. *d* 1. Of a liver brown colour and earthy texture, slightly indurated and light (*Umber*). *Franckfort.*

LXXXII. *d* 2. The same, more ponderous, but of an ochre yellow colour. (*Common Ochre.*) *Carintbia.*

LXXXIII. *d* 3. The same, very light and of a deep orange colour. *Silesia.*

LXXXIV. *d* 4. In an impalpable powder of a dull prussian blue colour. (*Native Prussian Blue.*) *Saxony.*  
*Catal. de Raab. 11 E. 1.*

LXXXV. *d* 5. The same, inclining to a lavender blue colour and mixed with portions of brown peat. *Scotland.*

LXXXVI. *d* 6. In a cohering ponderous mass, of a brownish red colour.

#### SPECIES IV. ARGILLACEOUS IRON ORE.

*Fer Limoneux, Fr. Thonartiger-Eisenstein, Germ.*

This may be distinguished into such as is found in drier and more elevated situations, and such as occurs in low or swampy. The former called *Higbland* or *Upland Ore*, is generally of different shades of grey, brown, red, or yellow, those of a lighter colour becoming darker on exposure to the air. It occurs either in strata; or in indeterminate nodules; or in nodules of particular shapes, as reniform, spheroidal, &c. or in small round and flattened portions (*Minera Ferri numismalis*); or in more or less regular spherules of

of different sizes (*Pea Iron Ore. Bobnerz*); or in testaceous petrifications, &c. Its texture usually compact, earthy and more or less even or inclining to the conchoidal, not unfrequently internally cellular or corroded, sometimes columnar (*Basaltic Iron ore*), sometimes composed of small distinct globular concretions (*Korniger thonartiger Eisenstein*.) Its nodules are sometimes hollow and enclose detached indurated spherules (*Ætites*), sometimes on being broken they exhibit vegetable impressions internally. It is always opaque, and for the most part without lustre. It generally adheres to the tongue, and has an earthy smell when breathed on; is often so soft as to soil the fingers, though sometimes nearly of sufficient hardness to give fire with steel. Specific gravity from 2.673 to 3.471. Under the blow-pipe it blackens and becomes attractable by the magnet. To glass of borax, with which it is effervescent, it communicates an olive green colour.

The *Lowland, Swampy, Marsh, or Meadow Ore* (*Rasen-Eisenstein, Morasterz, Sumpterz, Weisenerz*) is of a yellowish, blackish, or reddish brown colour, inclining sometimes to steel grey. It is found either loose or slightly coherent, or in compacted strata, or in detached nodules, which are sometimes reniform, tuberous, dentiform, &c. but generally amorphous, and often perforated. Its texture like the former earthy and more or less even; internally dull; opaque; has an earthy smell when breathed on; soils the fingers, but is never of sufficient hardness to give fire with steel. Specific gravity of the indurated 2.944. Before the blowpipe it is affected nearly in the same manner as the *Up-land Ore*, which yields from 30 to 40 or 50 per cent. of Iron; the Lowland only from 30 to 40. The iron thus procured is frequently found to be *cold-short*, owing, as the experiments of *Scheele* have shewn, to the presence of phosphoric acid.

These ores are in a great measure confined, the *Lowland Ores* more especially, to the northern, eastern, and north-eastern parts of the globe; they are the product of alluvial districts, and from these ores are supplied, the foundries of *Colebrook Dale*, and most of the other extensive iron works in this country.

#### VARIETY I. OF PARTICULAR SHAPES.

LXXXVII. *a* 1. In a flattened oval nodule of an ash-grey colour, having the impression of fern in the centre. *Calfhead.*

LXXXVIII. *a* 2. In a small irregular nodule of a brown colour. *Bobemia.*

LXXXIX. *b* 1. In small detached rounded nodules of different sizes and of an ash-grey colour.

XC. *b* 2. In loose spherical grains of a brown colour and polished surface. (*Pea Iron Ore.*) *Swabia.*

XCI. *b* 3.

- XCI. *b* 3. The same, imbedded in reddish ferruginous clay. *Hungary.*
- XCII. *b* 4. Of a dark chocolate brown colour, light and of a shining fracture.  
(*Bituminous Iron Ore.*) *Saxony.*
- XCIII. *b* 5. Composed of agglutinated globules of a brownish red colour.  
*Dean Forest.*
- XCIV. *c* 1. In large cylindrical aggregated stalactites, covered by yellow ochre.  
*Bareuth.*
- XCV. *c* 2. In smaller stalactites of a reddish brown colour, covered also by yellow ochre.  
*Nassau Siegen.*
- XCVI. *c* 3. In aggregated cylindrical stalactites, of a dark liver brown colour, covered on the surface by minutely crystallised quartz.  
*Dean Forest.*

VARIETY II. *AMORPHOUS.*

- XCVII. *a* 1. In an irregular mass of a columnar structure and dull purple colour.  
*Catal. de Raab. 11 F. b. 11. Hofschentz, Bohemia.*
- XCVIII. *b* 1. In a compact irregular mass, hollow internally and inclosing a loose nucleus. (*Ætites.*) *France.*
- XCIX. *b* 2. Of a compact conchoidal texture, and ochry yellow colour, cellular upon the surface.  
*Derbyshire.*
- C. *b* 3. In a flatted irregular piece, compact and of a liver brown colour, the surface artificially polished.  
*Germany.*
- CI. *b* 4. In irregular and hollow fragments, of a laminated texture and yellow colour.  
*Surry.*
- CII. *b* 5. In a tabular portion, compact, and of a yellowish brown colour. *Suffex.*
- CIII. *b* 6. Portion of an irregular nodule, internally of a liver brown, and externally of a bluish grey colour.  
*Colebrook Dale.*
- CIV. *b* 7. Another portion of the same, having undergone calcination.  
*South Wales.*
- CV. *b* 8. In an irregular mass, of a dull verdigris green colour. *Italy.*

CVI. *b* 9.

CVI. *b 9.* The same, of a lighter green colour and interspersed with angular fragments of reddish brown ochre (*Grün-Eisenerde.*) *Bobemia.*

# SPECIES V. SPATHOSE IRON ORE.

*Fer spatbique, Fr. Spatbiger-Eisenstein, Germ.*

The colour of this ore, when newly raised, is light greyish or yellowish white; but, being the result of the union or impregnation of calcareous spar with different portions of oxyde of iron and of manganese, it passes gradually upon exposure to air through different shades of grey and yellow, to dark brown, or even iron black, and is often superficially variegated. It occurs either in strata, or in amorphous masses, or intermixed with other ores, sometimes with impressions, seldom of particular shapes, but very frequently crystallised, and for the most part in rhomboidal parallelepipeds and their modifications. Its surface, particularly when crystallised, is smooth or druse, with more or less of a pearly or vitreous splendour, and as it is of a darker or lighter colour is less or more transparent. Its fracture foliated; fragments rhomboidal; hardness such as to allow of its being pretty easily scratched by the knife; specific gravity from 3.67 to 3.81. It is soluble with slight effervescence in all the mineral acids, and by digestion in solution of ammoniac it blackens and becomes magnetic. It undergoes a similar change on exposure to heat, by the continuation of which it loses about one third of its weight. To glass of borax it communicates a dull yellow colour. The spathose iron ore of *Eisenerz* in *Stiria* afforded *Bergman* Iron 38, Lime 38, Carbonic Acid and Manganese 24. In one from *Sweden* he found Iron 22, Manganese 28, Carbonate of Lime 50. It constitutes entire beds at *Eisenerz* in *Stiria*, at *Huttenberg* in *Carinthia*, at *Schmalkalden* in *Hesse*, &c. and is also found in different parts of *Baireuth*, *Bobemia*, *Saxony*, the *Hartz*, *Nassau* *Siegen*, *Salzburg*, *Spain*, the *Tyrol*, *Hungary*, &c.

## VARIETY I. CRYSTALLISED.

CVII. *a 1.* In large compound parallelepipeds, of a pearly white colour, with dodecahedral crystals of yellow iron pyrites, on amorphous spathose iron ore of a light brown colour. *Viziles, Dauphiné.*

*R. de L. Tom. 3, Pag. 284.*

CVIII. *a 2.* In numerous aggregated rhomboidal parallelepipeds, of a light liver brown colour on the surface of an amorphous mass of the same. *Biber, Baireuth.*

*R. de L. Pl. 4, Fig. 1.*

CIX. *a* 3. The same, intermixed with white quartz, the crystals on the surface semitransparent. *Biber, Bareuth.*

CX. *a* 4. Of a similar crystallisation and blackish brown colour. *Carinthia.*  
The dark colour of this depends on the presence of manganese.

CXI. *a* 5. In very minute variegated crystals, on the surface of an amorphous mass of the same of a clove brown colour. *Same place.*

CXII. *b* 1. In numerous aggregated semitransparent lenticular crystals, of a pale yellowish brown colour, on amorphous spathose iron ore intermixed with white quartz. *Bogorry.*

CXIII. *b* 2. In thinner and more irregularly aggregated lenticular crystals of a darker brown colour. *Bareuth.*

CXIV. *b* 3. In small lenticular crystals of a liver brown colour, with dodecahedral calcareous spar and cubic fluor. *Brittany.*

## VARIETY II. AMORPHOUS.

CXV. *a* 1. Of a foliated texture, dark brown colour and splendid, intermixed with white calcareous spar. *Nassau Siegen.*

CXVI. *a* 2. The same, more splendid, partly brownish partly ash coloured, intermixed with white quartz and yellow pyrites. *Bareuth.*

CXVII. *a* 3. The same, of a pale yellowish brown colour and without admixture. *Dauphiné.*

CXVIII. *b* 1. Compact and of a dark reddish brown colour, with transparent rhomboidal and pyramidal calcareous spar on the surface. *Carinthia.*

CXIX. *b* 2. The same, covered on one side by calcareous spar confusedly crystallised, opaque and of a milk white colour, and on the other by the same of a pearl colour. *Stiria.*

CXX. *b* 3. Compact and having the surface incrustated by mammillated milk-white indurated clay. *Same place.*

CXXI. *b* 4. The same, having the superficial clay incrustated with transparent pyramidal quartz. *Same place.*

CXXII. *c* 1.



CXXII. *c* 1. Spongy and of a dark brown colour, covered on the surface by yellow ochre. *Saltzbourg.*

# SPECIES VI. SULPHATE OF IRON.

*Vitriol de Fer, Fr. Eisen-Vitriol, Germ.*

This is seldom found free from admixture of sulphate of zinc and of copper or other extraneous substances. When pure it is of a sea-green colour and transparent, by decomposition becoming more or less ochry. It occurs either in rhomboidal or capillary crystals, stalactitical, efflorescent, or in solution. It is soluble in about six times its weight of cold water, is styptic to the taste, and with vegetable astringents assumes a black colour. By calcination it at first becomes yellow and afterwards red, losing about 40 per cent of its weight by the dissipation of its water of crystallisation. If urged by a still stronger heat it parts also with its acid. A hundred parts of this salt contain Oxyde of Iron 28, Sulphuric Acid 26, Water 46. It most frequently owes its origin to the decomposition of iron pyrites, and is found generally in Grottos, Caverns, and Galleries of the Mines of *Bohemia, Saxony, Hungary, Goslar* in the *Hartz, &c. &c.*

## VARIETY I. CRYSTALLISED.

*a.* In Rhombs.

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Capillary.

## VARIETY III. AMORPHOUS.

CXXIII. *a* 1. In a compact mass of a dull white colour and earthy texture. *Hungary.*

CXXIV. *a* 2. In a flatted irregular porous piece, translucent, and when held to the light of an emerald green colour. *Cornwall.*

CXXV. *b* 1. Of a pale green colour and loose fugary texture. *Goslar.*

CXXVI. *b* 2. The same, of a dull yellow colour. *High Cliff, Hampshire.*

## SPECIES VII. SULPHURET OF IRON.

*Iron Pyrites, Pyrite sulfureuse, Fr. Schwefelkies, Germ.*

A variation in the proportion of the constituent parts, as well as in the degree of oxydation of its iron, produces considerable diversity in the properties and appearance of this ore, which is found in great abundance. Its colour is pale yellow with metallic lustre, or steel grey, sometimes inclining to brown and not unfrequently variegated. It occurs either in strata, or extensive beds; in lumps; interspersed; superficial; or of particular shapes, as stalactitic, capillary (*Haarkies*), &c. or as having taken the place and form of various animal and vegetable substances; or crystallised in tetrahedrons, cubes, or octohedrons, and their various modifications. It is sometimes slightly attracted by the magnet (*Magnetischer-Kies*), and always of sufficient hardness to give fire with steel. Its fracture generally compact and more or less uneven, sometimes granular, sometimes striated or fibrous (*Strahlkies*). Specific gravity from 3.44 to 4.789; opaque. On exposure to the atmosphere some varieties gradually decompose and are converted into sulphate of iron; others, though they retain their form, lose their splendour, hardness and specific gravity, and become more or less of a liver brown colour (*Fer hépatique, Leberkies*), while others remain unchanged, more especially the cubic. Before the blow-pipe most of the varieties of this ore decrepitate, emit a strong sulphureous smell and burn with a blue flame, leaving a brownish oxyde which tinges borax of a dull green. According to the opinion of *Mr. Kirwan*, those which most easily vitriolize contain iron in its metallic state, while in the others it is more or less oxydated. *Henkel* states the proportion of sulphur in pyrites to be between  $\frac{1}{4}$  and  $\frac{1}{3}$  its weight. This ore is so universally met with as to render it unnecessary to say from whence it can be most readily obtained. It abounds in coal mines, and frequently, as already mentioned, forms entire strata. The globular occurs often in beds of clay or chalk, the crystallised and more brilliant generally with argillaceous schistus. As this ore is seldom worked for its iron, it has by *Baron Born*, *Mr. Kirwan* and others, been ranked as an inflammable substance under the head of sulphur.

## VARIETY I. CRYSTALLISED.

a. In tetrahedrons and their varieties.

CXXVII. *b* 1. In smooth detached cubes and parallelepipeds of different sizes, and of a pale brassy yellow colour. *Tyrol.*

*R. de L. Pl. 2, Fig. 1, 2, 3, 4.*

CXXVIII. *b* 2. In large smooth aggregated cubes of the same colour. *Hungary.*

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CXXIX. *b* 3.

CXXIX. *b* 3. The same, imbedded in greenish argillaceous slate. *Barentz.*

CXXX. *b* 4. In numerous small and more brilliant cubes, covering the surface of black slate or calc. *County of Dublin.*

CXXXI. *b* 5. In small detached striated cubes. *Tyrol.*  
And in larger aggregated crystals. *Cornwall.*  
*R. de L. Pl. 2, Fig. 17.*

CXXXII. *b* 6. In large striated cubes of a pale brass yellow colour, irregularly aggregated on the surface of a compact mass of iron pyrites. *France.*

CXXXIII. *b* 7. In aggregated cubes of a deeper colour, truncated at their solid angles. *Elba.*  
*R. de L. Pl. 2, Fig. 5.*

CXXXIV. *b* 8. In small loose striated cubes, truncated at all their edges. *Tyrol.*  
*R. de L. Pl. 2, Fig. 18.*

CXXXV. *b* 9. The same, having their edges more deeply truncated. *Same place.*  
*R. de L. Pl. 2, Fig. 19.*

CXXXVI. *b* 10. In aggregated cubes slightly truncated in all their edges and solid angles, of a pale yellow colour and somewhat variegated; some of the cubes partly corroded. *Germany.*  
*R. de Pl. 2, Fig. 20.*

CXXXVII. *b* 11. In detached dodecahedrons with pentagonal faces. *Tyrol.*  
*R. de Pl. 2, Fig. 27.*

CXXXVIII. *b* 12. In small brilliant dodecahedrons aggregated into an irregular mass, with crystallised galena on quartz. *Geyer.*

CXXXIX. *b* 13. The same, in larger crystals, implanted on grey opaque calcareous spar. *Kongberg.*

CXL. *c* 1. In aggregated octohedrons slightly truncated in all their solid angles, on greyish limestone. *Bath.*  
*R. de L. Pl. 3, Fig. 4.*

CXLI. *c* 2.

CXLI. *c* 2. The same, in very brilliant crystals, having, besides the truncation at the angles, two opposite edges slightly bevilled, with transparent pyramidal calcareous spar, also on greyish limestone. *Bath.*

CXLII. *d* 1. In parallelepipeds irregularly rhomboidal and aggregated into a mass. *R. de L. Vol. 3, P. 242. Ehrenfriedersdorf.*

CXLIII. *d* 2. The same, of a pale yellow colour, in smaller crystals, and more confusedly aggregated (*Cocks-comb Pyrites*), on galena with cubic fluor. *Derbyshire.*

CXLIV. *e* 1. In confusedly aggregated crystals, producing a flatted tubercular appearance on the surface. *Cornwall.*

CXLV. *e* 2. The same, in more minute crystals, appearing specular on the surface. *Same place.*

CXLVI. *e* 3. The same, in still more minute iridescent crystals, lining the fissures of brown argillaceous iron ore. *Brittany.*

#### VARIETY II. OF PARTICULAR SHAPES.

CXLVII. *a* 1. In detached cylindrical and spherical portions, of a brown colour and without splendour. *Coast of Essex.*

CXLVIII. *a* 2. In small irregular vermiform stalactites, covered with very minute crystals of pyrites of bright and variegated colours, on grey cellular quartz. *Lorraine.*

CXLIX. *a* 3. Of a pale yellow colour and irregularly botroidal on the surface, on brownish opaque petrosilex. *Bobemia.*

CL. *b* 1. In delicate needle-like crystals diverging from different centres, in a cavity of coarse schistus lined with minutely crystallised quartz. *Jobngeorgenstadt.*

CLI. *c* 1. In a rounded spherule, smooth on the surface, and of a dark brown colour. *Sheppey Isle, Essex.*

CLII. *c* 2. In aggregated spherules more irregular on the surface. *Same place.*

CLIII. *c* 3. Portion of an irregular spherical nodule, externally dull, internally of a radiated texture, and of a pale brass yellow colour. *Same place.*

CLIV. *c* 4.



CLIV. *c* 4. In variegated prominent tubercles, on white quartz covered by minutely crystallised calcareous spar. *Hartz.*

CLV. *c* 5. In a rounded portion, bearing internally the impression of a *Cornu Ammonis*. *Isle of Sheppey.*

CLVI. *d* 1. Of a dusky hue and cellular texture, having in many of the cells small portions of decomposing galena. *Hungary.*

### VARIETY III. AMORPHOUS.

CLVII. *a* 1. Of a fibrous texture and bright surface, the fibres long and delicate, running mostly parallel and closely compacted. *Jobngeorgenstadt.*

CLVIII. *a* 2. Of a close striated texture. *Cornwall.*

CLIX. *b* 1. Of a scaly or granular texture, forming a coating on pyramidal calcareous spar, and retaining the impressions of it on the surface. *Derbyshire.*

*c.* Compact.

CLX. *d* 1. In an irregular decomposing mass.

### VARIETY IV. PASSING INTO HEPATIC IRON ORE.

#### VARIETY I. CRYSTALLISED.

*a.* In tetrahedrons and their modifications.

CLXI. *b* 1. In smooth detached cubes and parallelepipeds of different sizes.

*R. de L. Pl. 2, Fig. 1, 2, 3, 4.*

*Hartz.*

CLXII. *b* 2. In loose striated cubes, one simple and entire, the others in masses.

*Same place.*

CLXIII. *b* 3. In dodecahedrons with pentagonal faces, aggregated into a spherical cluster. *Dalmatia.*

CLXIV. *b* 4. In loose spherical clusters ochry on the surface, composed of small aggregated cubes variously truncated, some octohedral. *Isle of Sheppey.*

CLXV. *b* 5.

CLXV. *b* 5. In small smooth rhombic crystals, some entire, some truncated obliquely at their edges. *Dalmatia.*

*c.* In octohedrons.

CLXVI. *d* 1. In rhomboidal parallelepipeds presenting cuneiform edges, implanted on an aggregated mass of the same. *Derbyshire.*

*e.* Indeterminate.

#### VARIETY II. OF PARTICULAR SHAPES.

CLXVII. *a* 1. Forming a conical stalactite, rough and ochry on the surface.

CLXVIII. *a* 2. Confusedly aggregated, and forming an irregular cluster, on the surface of a cylindrical piece of hepatic iron ore. *Derbyshire.*

CLXIX. *a* 3. In numerous fine diverging fasciculi, forming an irregular ochry brush-like surface, on black iron ore. *Lorraine.*

CLXX. *a* 4. Portion of a nodule of a blackish brown colour, having a rough surface, and enclosing black indurated bitumen. *Baireuth.*

CLXXI. *a* 5. In a small irregular mass of a brownish black colour, botryoidal and shining on the surface. *Hungary.*

CLXXII. *a* 6. In an irregular bulbous nodule of a liver brown colour.

#### VARIETY III. AMORPHOUS.

CLXXIII. *a* 1. Forming a compact vein in red jasper.

CLXXIV. *a* 2. In small loose irregular fragments. *Eisenbock.*

#### GENUS VIII. TIN.

*Stannum.* *Etain,* Fr. *Zinn,* Germ.

Is a metal of a silvery white colour and of considerable lustre; soft, malleable, slightly sonorous, and of but little tenacity, a wire of  $\frac{1}{8}$  of an inch in diameter being only capable of sustaining a weight of  $49\frac{1}{2}$  pounds. It is the lightest of the metallic bodies, its specific gravity being little more than seven times that of water, viz. from

7.063

7.063 to 7.331. Between the teeth, or in the act of bending or breaking, it occasions a peculiar crackling, and on being rubbed or heated has an ungrateful smell and taste. On being exposed to air or moisture it becomes superficially dull, but suffers no further alteration. It melts at 410 *Farenh.* If exposed to the combined action of heat and air it is readily converted into a greyish or whitish oxyde, which added to glass communicates to it an opaline opacity and colour, *Common Enamel*. In its metallic state it detonates rapidly with nitre. It decomposes all the mineral acids, but dissolves most readily in the oxy-muriatic or in aqua regia, the solutions in which are remarkable for giving a bright scarlet colour to the infusion of cochineal. When united to oxy-muriatic acid in the dry way, it produces a colourless liquor, strongly disposed to assume the gaseous form on exposure to the air, *Smoking Liquor of Libavius*. By fusion it combines with the other metals in all proportions, diminishing remarkably the malleability of gold, silver, and copper, more especially that of gold, which is rendered fragile even by exposure to its fumes. United with a small proportion of iron it becomes harder, more sonorous, and of greater splendour. By simple trituration it amalgamates with quicksilver. It may by fusion be combined also both with sulphur and phosphorus; with the former producing a dark striated compound, which sublimed in close vessels becomes of a beautiful golden colour and spongy texture, *Aurum Musivum*.

The chief uses of this metal are, in the composition of solder, pewter, bell-metal, and of printers types, in the construction of mirrors, in tinning, enamelling, and in medicine. Whether tin has yet been met with in its native state, is very doubtful. Its ores are,

#### SPECIES I. NATIVE OXYDE.

*Spathose Tin Ore. Etain vitreux, Fr. Zinnstein, Germ.*

This, though comparatively a rare ore, may be considered as almost exclusively that from which tin has hitherto been procured. It occurs either in beds or veins (*Zinnstein*), interspersed (*Zwitter*), or in loose grains (*Zinnsand, Seifenzinn*), or in detached irregular portions, or crystallised (*Zinngraupe*), and then generally in obtuse tetrahedral pyramids with or without intermediate prisms, or in dodecahedrons with rhombic faces, and their modifications. Its colour, different shades of black, brown, yellow, or grey; as brownish black, clove or nut brown, wine or Isabella yellow, smoke grey, &c. and sometimes blood red; but this probably from decomposition. Its crystals are generally smooth, sometimes striated, have more or less of a glassy lustre, and are more or less transparent in proportion to the lightness of their colour; they are sometimes of considerable size, seldom distinct, on the contrary generally implicated in each other, or in maccles. The fracture of this ore is fine grained and uneven, inclining to the conchoidal or foliated; it is of sufficient hardness to give fire with steel; brittle; specific gravity from 6.3 to 6.989.

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It is difficultly soluble in the acids. Under the blow-pipe it decrepitates, loses its colour, and on charcoal is in part reduced. By simple torrefaction it is converted into a greyish oxyde, which gives a white tinge to glass of borax. It is met with most frequently in the veins of primitive mountains, more especially of those of granite, gneiss and micaceous schistus; frequently also as collected in strata of subaqueous formation. Its more common associates are quartz, mica, lithomarga, steatite, fluor, clay, chlorite, pyrites, wolfram, blende, &c. It has as yet been principally procured from the mines of *Malacca*, *Banca*, and *Siam*, and those of *Bohemia*, *Saxony*, and *Cornwall*.

The wood tin of Cornwall (*Etain mamelonné ou en Stalactites*, *Etain limoneux*, Born. *Kornisches Zinnerz*, Germ.) may from its composition be considered as a variety of the foregoing, though different in several of its characters. It is always found in small fragments more or less rounded. Its colour light or dark brown, inclining to the yellowish grey or Isabella yellow, and having frequently in the same piece transverse parallel stripes incurvated and of different shades. Externally it is somewhat rough and of but little splendour, internally silky. Its texture delicately fibrous, the fibres generally diverging and fasciculated; specific gravity from 5.8 to 6.45. Under the blow-pipe it becomes brownish red, and at length decrepitates, but can neither be melted *per se*, nor with glass of borax. It has hitherto only been met with at *St. Columb*, *St. Dennis*, and *St. Roch* in *Cornwall*. By *Klaproth's* analysis it contains, Tin 63.3, with a little Iron and Arsenic; the common native oxyde, according to *Born*, contains no Arsenic, and by *Kirwan* is stated to consist of Oxyde of Tin 80, the remainder Oxyde of Iron.

#### VARIETY I. CRYSTALLISED.

I. Pure tin, artificially crystallised on the surface.

II. *a* 1. In loose, dark brown and shining tetrahedral prisms terminated by tetrahedral pyramids, some perfect, others variously truncated. *Cornwall*.

*R. de L. Pl. 3, Fig. 26, 27, 28, 29.*

III. *a* 2. In more minute and lighter coloured crystals, on light brown scaly spathose tin ore intermixed with quartz. *Same place.*

IV. *a* 3. In long shining, tetrahedral prisms with the edges of the corresponding pyramid slightly truncated, implanted on the surface of grey limestone, intermixed with green chlorite, crystallised quartz, and purple fluor. *Same place.*

V. *b* 1. In regular dodecahedrons with rhombic faces, of a brownish black colour and shining surface, implanted on compact tin ore of the same colour. *Bohemia.*

*R. de L. Pl. 4, Fig. 106.*

VI. *b* 2.



VI. *b* 2. The same, of a dark olive green colour, numerously interspersed through white calcareous spar, on brown spathose tin ore. *Bobemia.*

VII. *b* 3. The same, in more numerous crystals, of a blackish brown colour and striated on their surfaces. *Altenberg.*

In these two last the proportion of iron is so considerable as to render them attractible by the magnet even before torrefaction.

VIII. *b* 4. The same, truncated at their edges, intermixed with yellow copper ore and calcareous spar, on amorphous brown spathose tin ore. *Lower Hungary.*

IX. *b* 5. The same, also truncated at all their edges and variegated internally. *Transylvania.*

The proportion of iron contained in the foregoing (Nos. 5, 6, 7, 8, and 9), and the peculiarities of their form, lead justly to the suspicion that they approach to the nature of *Garnet*.

X. *b* 6. In large lengthened hexhedral prisms terminated by trihedral pyramids having rhombic faces, semitransparent at their edges and adhering laterally. *Bobemia.*  
*R. de L. Pl. 4, Fig. 88.*

XI. *b* 7. In regular dodecahedrons, implanted with crystallised quartz on red argillaceous iron ore. *Altenberg.*

XII. *b* 8. In black splendid dodecahedrons or double hexhedral pyramids, with cuneiform summits, implanted diagonally and aggregated on compact brown tin ore. *Cornwall.*  
*R. de L. Pl. 6, Fig. 7.*

XIII. *b* 9. The same, in larger and lighter coloured crystals implanted on purple fluor. *Bobemia.*

XIV. *b* 10. The same, more irregularly aggregated, with crystallised quartz and white mica. *Schlackenwalde, Bobemia.*

XV. *b* 11. The same, in still larger and more closely aggregated crystals, of a dark brown colour, striated and shining on the surface, on quartz with ferruginous clay. *Bobemia.*

XVI. *b* 12. Fragment of a dodecahedron, of a liver colour, truncated at one of its angles. *Cornwall.*

XVII. *b* 13. In very large maccles or compounded dodecahedrons with reflected angles.

angles, truncated also at one of the angles, of a black colour, smooth and splendid on the surface.

*Bobemia.*

XVIII. *b* 14. In smaller crystals, forming a cluster, adhering to the base of a crystal of white quartz.

*Cornwall.*

XIX. *b* 15. In large aggregated dodecahedrons having the edges of the prism truncated, on indurated talc intermixed with quartz.

*Bobemia.*

*R. de L. Pl. 3, Fig. 27.*

XX. *b* 16. In very confusedly aggregated dodecahedrons with the edges of the pyramid truncated, implanted on the surface of a large fragment of crystallised quartz.

*Same place.*

XXI. *b* 17. The same, in smaller, less splendid, and more numerous crystals, on the surface of gneiss.

*Same place.*

XXII. *b* 18. In dodecahedrons having the edges of both pyramids and prisms truncated, with white quartz, forming a vein the sides of which are argillaceous.

*Saxony.*

*R. de L. Pl. 3, Fig. 28.*

XXIII. *b* 19. The same, of a dark brown colour, incrustated with yellowish talc.

*Bobemia.*

XXIV. *b* 20. The same, in more minute crystals, on compact tin ore, also incrustated with yellowish talc.

*Same place.*

XXV. *b* 21. The same, in dull white talc, intermixed with white crystallised quartz.

*Same place.*

XXVI. *b* 22. The same, in smaller and more numerous crystals, on compact spathose tin ore.

*Same place.*

XXVII. *b* 23. The same, with crystallised quartz, purple fluor, and whitish talc.

*Ehrenfriedersdorf.*

XXVIII. *c* 1. In compounded crystals, of a dark brown colour and shining surface, implanted on greenish indurated clay.

*Altenberg.*

XXIX. *c* 2. In indeterminate crystals with greenish white indurated steatite, on a plate of gneiss.

*Bobemia.*

XXX. *c* 3.

XXX. c 3. In aggregated indeterminate masses, with yellow copper ore, quartz, fluor, and red ochre. *Bobemia.*

XXXI. c 4. The same, of a brownish red colour and semitransparent. *Ehrenfriedersdorf.*

XXXII. c 5. The same, of a lighter colour, forming a vein the sides of which are covered by green indurated talc. *Same place.*

XXXIII. c 6. In semitransparent indeterminate crystals, striated on the surface and of a white colour, with brown spathose tin ore on gneiss. *Same place.*

The striated texture and configuration of the crystals in this specimen distinguish them sufficiently from *Tungsten*.

XXXIV. c 7. In small prismatic crystals on cellular quartz. *Cornwall.*  
(*Needle Tin.*)

XXXV. c 8. In very minute prisms, transparent and of a brownish colour, on grey crystallised quartz. *Same place.*

XXXVI. c 9. In an aggregated mass, composed of polyhedral crystals of a brown colour, brown radiated shorl, and white crystallised quartz. *Same place.*

XXXVII. c 10. In small polyhedrons of a dark brown colour, intermixed with brown shorl, quartz, and yellowish talc. *Bobemia.*

XXXVIII. c 11. In polyhedral crystals of a dark brown colour, with crystallised mica, in ferruginous crystallised quartz. *Zinnwald, Bobemia.*

XXXIX. c 12. In detached fragments of large polyhedral crystals, semitransparent, and of a light reddish yellow colour. (*Refin Tin Ore.*) *Bobemia.*

XL. c 13. The same, of a darker colour and less transparent. *Same place.*

XLI. c 14. A variety of the same. *Cornwall.*

XLII. c 15. In brown polyhedral crystals in talciferous argillite. *Bobemia.*

## VARIETY II. AMORPHOUS.

XLIII. a 1. In loose fragments, chiefly of a light liver brown colour and radiated texture, some of the pieces angular, others rounded. (*Wood Tin.*) *Same place.*

XLIV. *a* 2. In larger and more rounded pieces.

*Same place.*

XLV. *b* 1. In an irregular mass of an iron grey colour and granular texture, strongly attracted by the magnet.

*Jobnsgeorgensbadt.*

XLVI. *b* 2. In small specks, of a pale liver-brown colour, interspersed through grey granite.

*Cornwall.*

XLVII. *c* 1. Of a solid texture and brownish grey colour, with small veins of white quartz.

*Bobemia.*

XLVIII. *c* 2. Of a light brown colour, semitransparent and of a vitreous fracture, specular on the surface.

*Same place.*

XLIX. *c* 3. Of a brownish black colour, compact and very ponderous, with a small fragment of white quartz.

*Same place.*

L. *d* 1. In large detached nodules. (*Sboad Tin.*)

*Cornwall.*

LI. *e* 1. In large loose angular grains of a dark colour.

*Same place.*

LII. *e* 2. In more rounded grains, mostly of a light brown colour and semitransparent.

*Same place.*

LIII. *e* 3. In a loose sandy form, of a clove brown colour.  
(*Stream Tin.*)

*Same place.*

LIV. *e* 4. The same, of a darker colour, and intermixed with particles of native gold.

*Same place.*

LV. *e* 5. The same, intermixed with grains of white quartz. *Junkelow, Isle of Banca.*

## SPECIES II. SULPHURET OF TIN.

*Bell-metal Ore. Etain Sulphuré, Fr. Zinnkies, Germ.*

The colour of this ore, as described by *M. Klaproth*, is bluish white, approaching to steel grey, and resembling that of *Grey Copper*; in most specimens however the grey is found to incline more or less to brass or bronze yellow. Its lustre is metallic; form amorphous; fracture uneven, of a coarse or fine grain, inclining to the conchoidal or imperfectly foliated. It is brittle and separates into sharp-edged indeterminately angular fragments; of moderate hardness, scratching easily with the knife: specific gravity 4.35. Under the blow-pipe it fuses readily into a black globule, tinging the charcoal at the same time of a bluish colour, and emitting a sulphureous smoke with a slight impregnation

nation of arsenic; by a more gentle and continued heat it is converted into a reddish oxyde. On digestion in aqua regia its metallic part is almost wholly dissolved, and its sulphur rises to the surface.

According to what *Mr. Klaproth* considers as his most accurate analysis of this ore, it consists of Sulphur 25, Tin 34, Copper 36, Iron 3, Earthy matter 2. It has as yet been found only in *Cornwall*, where it was discovered some years since by the late *Mr. Raspe*, at *Huel Rock* in the parish of *St. Agnes*, in a vein nine feet wide and twenty yards from the surface.

#### VARIETY I. AMORPHOUS.

a. Fibrous.

LVI. *b* 1. Of a pale brass yellow colour and compact texture.

*Huel Rock, Cornwall.*

#### ORDER II. FRAGILE.

#### GENUS IX. BISMUTH.

*Wismuthum. Bismuth, Fr. Wismuthum, Germ.*

Pure regulus of bismuth is of a silver white colour with an admixture of yellowish red, becoming in a slight degree iridescent on exposure to air. Its lustre and hardness nearly the same with those of tin and lead; texture foliated; brittle, though with a slight degree of malleability; specific gravity according to *Briffon* 9.822. Next to tin it is the most fusible of the metallic bodies, melting at 460 of *Farenh.* By increase of heat in close vessels it sublimes without alteration, and in cooling crystallises into cubes; but in the open fire it inflames, and is easily converted into a yellowish vitrifiable oxyde. Though neither soluble in the sulphuric nor muriatic acid without the assistance of heat, it dissolves readily both in the nitric and oxy-muriatic, and with the former furnishes a salt which detonates on being suddenly heated, and which on the addition of water yields a copious white precipitate (*Magistery of Bismuth, Spanish White*). With the exception of arsenic, cobalt, and zinc, it combines with all the other metallic bodies, renders them paler and more brittle, and, platina, gold and silver excepted, more susceptible of oxydation; some it also renders more fusible. In moderate quantity it scarcely diminishes the fluidity of quicksilver, with which it readily amalgamates; it also promotes its disposition to union both with lead and tin. Its principal uses are, in the composition of pewter,

soft

soft solder, and printers types; in the construction of mirrors, assaying, painting, and imitation of silver. Its ores are,

### SPECIES I. NATIVE BISMUTH.

*Bismuth natif*, Fr. *Gediegen-Wismuth*, Germ.

The properties of this are analogous to those of the regulus; its colour being reddish white, lustre metallic, fracture foliated, specific gravity from 9.022 to 9.57. It is seldom found in veins; most commonly interspersed, and then either in small grains or scales, or in laminæ, often producing cellular, reticular, penniform (*Federwismuth*), or dendritic appearances; and sometimes, though rarely, crystallised in equilateral triangular or quadrangular plates. It is generally associated with the grey and white ores of cobalt, with kupfernickel, iron pyrites and blende, in a matrix of quartz, hornstone, jasper, or of calcareous, pearl, and ponderous spars. It occurs principally in the mines of *Biber*, *Bohemia*, *Saxony*, *Swabia*, *Sweden*, *Transylvania*, and the *Temefwar*.

### VARIETY I. CRYSTALLISED.

I. Pure bismuth artificially crystallised.

II. *a* 1. In thin rhomboidal laminæ, of a dull silver white colour, on compact native bismuth, with pale green oxyde of nickel efflorescent on the inferior surface.

*Jaachimthal.*

III. *b* 1. Partly granulated, partly in broad striated laminæ, of a brighter colour, producing a penniform appearance, in reddish white calcareous spar.

*Schneeberg.*

### VARIETY II. OF PARTICULAR SHAPES.

IV. *a* 1. Of a fine laminated texture and tarnished silver white colour, forming numerous dendritic ramifications through the substance of brownish red jasper.

*Schneeberg.*

V. *a* 2. The same, cut and polished.

*Joanngesengstadt.*

VI. *a* 3. The same, of a greyer colour, in semitransparent petriflex, also cut and polished.

*Schneeberg.*

VII. *a* 4.

VII. *a* 4. Forming ramifications in reddish white ponderous spar, polished on one side. *Fürstenberg.*

*b.* Penniform, *Vide* No. III.

### VARIETY III. AMORPHOUS.

VIII. *a* 1. Of a tarnished silvery white colour and laminated texture, in reddish petrofilex. *Altenberg.*

IX. *a* 2. The same, very compact, ponderous and without matrix. *Joachimsthal.*

X. *a* 3. In small folia, somewhat variegated in their colour, intermixed with baroselenite, white quartz, and small cubic crystals of grey cobalt ore. *Schneeberg.*

XI. *a* 4. In folia so fine as to have the appearance of coarse grains, and somewhat cellular, from the folia not being closely compacted; of a brown colour on the surface, in some places inclining to purple. *Fürstenberg.*

XII. *b* 1. In fine grains disseminated through yellowish ponderous spar. *Same place.*

XIII. *b* 2. In a mass composed of fine grains, iridescent on the surface. *Bohemia.*

XIV. *b* 3. The same, of a compact granular texture, angular and variegated in its fracture, intermixed with reddish petrofilex. *Schneeberg.*

XV. *b* 4. The same, forming a rich vein in a matrix of grey quartz. *Joachimsthal.*

XVI. *b* 5. The same, with yellowish green oxyde of nickel, efflorescent on the surface. *Schneeberg.*

XVII. *b* 6. The same, covered by peach bloom coloured oxyde of cobalt. *Same place.*

### SPECIES II. NATIVE OXYDE OF BISMUTH.

*Oxide de Bismuth, Fr. Wismutbokker, Germ.*

This occurs either in the form of powder, or more or less concreted, of a straw or greenish yellow, or greyish colour; often covering the surface of, or interspersed through other ores. It is nearly without splendour; when indurated has an earthy fracture; is

F f

friable,

friable, and of considerable weight. On charcoal it is easily reduced by the blow-pipe. It is soluble in the nitric acid without effervescence. In the few specimens hitherto met with, it has been found generally accompanied with native bismuth, and often with different ores of cobalt, quartz, pearlspar, argillaceous schistus, and indurated clay. The mines which have produced it in the greatest abundance are those of *Jobngeorgenstadt*, *Joachimsthal*, and the *Black Forest*, and more especially of *Schneeberg* in *Saxony*.

#### VARIETY I. AMORPHOUS.

XVIII. *a* 1. Of a yellowish ash-colour, on the surface of, and intermixed with granulated native bismuth, with grey indurated clay. *Jobngeorgenstadt*.

XIX. *a* 2. Of a lemon yellow colour, on the surface of ferruginous indurated clay, intermixed with laminated native silver. *Same place*.

*b*. Friable.

XX. *c* 1. Of a pale yellow colour and powdery form. *Same place*.

XXI. *d* 1. Of an ochre yellow colour and indurated, on greyish ferruginous quartz. *Same place*.

XXII. *d* 2. Of a pale yellow colour, indurated and intermixed with arseniate of cobalt and tabular baroselenite. *Same place*.

XXIII. *d* 3. The same, of a darker colour. *Same place*.

XXIV. *d* 4. Of a liver brown colour, with oxyde of nickel and grey blende. *Zellerfeld, Hartz*.

#### SPECIES III. SULPHURET OF BISMUTH.

*Bismuth sulphuré*, Fr. *Wismuthglanz*, Germ.

This, which is also a rare ore, is of a pale leaden grey colour and generally superficially variegated with yellow, red, or purple. It is found in lumps, or coarsely interspersed, and sometimes in acicular aggregated prismatic crystals. Its lustre metallic; fracture foliated; fragments angular; specific gravity from 6.13 to 6.467. It is brittle; cuts easily with the knife; slightly stains the fingers. Before the blow-pipe it melts easily, and by continuance of the heat is gradually dissipated in the form of a sulphureous metallic vapour. It contains according to *Sage* 60 per cent. of Bismuth, the remainder Sulphur and Iron.



Iron. The nitric and oxymuriatic acids act readily on its metallic part to the exclusion of its sulphur. The common associates of this ore are native bismuth, spathose iron ore, mispikel, copper pyrites, native oxyde of tin, quartz, fluor spar, and wacke; and the mines principally producing it are those of *Jochimsthal*, *Johngeorgensstadt*, *Schwarzenberg*, *Altenberg*, and *Riddarhyttan* in *Westmanland*.

### VARIETY I. AMORPHOUS.

XXV. *a* 1. Of a greyish colour, partly striated, partly granular, intermixed with native bismuth. *Johngeorgensstadt*.

XXVI. *a* 2. The same, with a large proportion of native bismuth. *Hungary*.

XXVII. *b* 1. Of a dark steel grey colour, partly granulated and partly of a scaly texture. *Wurtemberg*.

XXVIII. *b* 2. Of a laminated texture with native bismuth, in reddish petrofilex. *Altenberg*.

### GENUS II. NICKEL.

*Niccolum*. *Nickel*, Fr. *Nikkel*, Germ.

The properties of this metal are the less easily assignable that it has not hitherto been procured in a state of perfect refinement. When of the ordinary degree of purity its colour is greyish white, inclining to copper red; lustre the same as that of the other semi-metals; fracture compact and more or less uneven; nearly of sufficient hardness to give fire with steel. Its specific gravity, according to the manner of its previous fusion, from 7.087 to 9.333. It possesses the property of being attracted by the magnet in common with iron, like which it is only capable of being melted in the higher degrees of heat. Under ignition in the open fire it is slowly converted into a brownish or greenish oxyde, which communicates a hyacinth colour to glass of borax and to soda, a honey yellow to microcosmic salt, and a blue to pot-ash. All the solutions of nickel are of a green colour, that in the nitric acid, in which it dissolves most readily, affords rhombic crystals by evaporation and cooling, and a bluish precipitate on the addition of ammoniac. It detonates, like most of the other metals, with nitre, and may be united by fusion with sulphur, arsenic, and cobalt. The uses of this metallic substance are as yet unknown. Its ores are,

## SPECIES I. NATIVE NICKEL.

*Nickel martial, Oxide de Nickel, Fr. Nikkelokker, Germ.*

As mentioned by *Baron Born*, occurs in rhomboidal tablets accumulated on each other, of a foliated texture, and brittle; in its fresh fracture of a pale yellow colour, which on exposure to the air changes to a blackish grey. Under the blow-pipe it discovers no traces either of arsenic or sulphur, and is said to consist solely of Nickel and Iron. It was a few years since discovered at *Joachimsthal* in *Bobemia*, accompanied with red silver ore in an argillaceous schistus, and appears to be analogous to that of a dark red colour mentioned by *Rinman*, from *Biber* in *Hesse*. Vide *Kirwan's Elem. Mineral* 1784, *Pag.* 342.

## VARIETY I. CRYSTALLISED.

I. Pure regulus of nickel.

a. In rhomboidal tables.

## VARIETY II. AMORPHOUS.

a. Foliated.

## SPECIES II. NATIVE OXYDE OF NICKEL.

*Oxide de Nickel, Fr. Nikkelokker, Germ.*

The colour of this is analogous to that of the artificial oxyde, viz. apple or grass green, or greenish white. Like the native oxyde of bismuth, it generally occurs either in a powdery form, or of different degrees of induration, superficial, in lumps, or interspersed; sometimes, according to *Kirwan*, in minute acicular crystals. The indurated is of an earthy texture with little lustre, but of considerable weight; it feels meagre, and has an earthy smell when breathed on. By the blow-pipe it is infusible *per se*, but communicates a yellowish red tinge to glass of borax. It is sometimes found to be partially soluble in water, from the accidental presence of the sulphuric acid: its solutions in this and the other acids (in which it dissolves slowly) are of a green colour and have the other properties of those of its artificial oxyde. In most instances it appears to result from the decomposition of kupfernickel, with which it is constantly associated; and is met with not unfrequently

frequently in the mines of *Saxony*, the *Hartz*, *Hesse*, *Sweden*, and the *Bogojablensky Mountains* in *Siberia*.

#### VARIETY I. AMORPHOUS.

II. *a* 1. Of an earthy texture, and apple-green colour, intermixed with brownish decomposing kupfernickel, having minutely crystallised white calcareous spar on the surface. *Andreasberg, Hartz.*

III. *a* 2. The same, of a paler colour, with kupfernickel less decomposed, and more compact and ponderous. *Same place.*

IV. *a* 3. In an indurated irregular mass, of a very pale green colour. *Saalfeld.*

V. *a* 4. In loose portions, of a pale green colour. *Hartz.*

VI. *a* 5. Of a pale green colour, with calcareous spar, on grey cobalt ore. *Same place.*

*b.* Pulverulent.

#### SPECIES III. KUPFERNICKEL.

*Nickel metallique*, Born. *Kupfernikkel*, Germ.

Is either of a light or deep copper red colour, sometimes inclining to white, yellow, or grey. It is found in lumps or disseminated, seldom reticular or arborefcient; its lustre metallic; its fracture fine grained, compact and more or less uneven, approaching sometimes to the conchoidal. It is difficultly scratched with the knife, and is brittle. Its specific gravity from 6.608 to 6.648, *Briffon*, and according to *Gellert* 7.56. Under the blow-pipe it exhales both an arsenical and sulphureous smoke, and melts into a globule, which loses its lustre on exposure to the air. By calcination it is converted into a green oxyde, similar in its properties to the foregoing. It is soluble both in the nitric acid and aqua regia, and imparts to both its characteristic green colour. By *Bergman* and most other authors it is considered as resulting from the union of different proportions of Nickel with Iron, Arsenic, Cobalt, and Sulphur. It occurs as well in primitive as in alluvial mountains, accompanied generally with grey and white cobalt, and often with rich silver ores, in a matrix of ponderous calcareous or pearl spar or quartz, in the mines of *Bohemia*, *Saxony*, *Sweden*, *Swabia*, *Stiria*, *Thuringia*, the *Hartz*, *Hesse*, *Spain*, *France*, and *England*.

#### VARIETY

## VARIETY I. OF PARTICULAR SHAPES.

VII. *a* 1. In very minute ramifications, of a high copper red colour, on grey cobalt ore with green calx of nickel. *Hartz.*

VIII. *a* 2. In aggregated tubercles, of a pale copper colour in their fracture, and covered on the surface by an efflorescence of pale green oxyde of nickel, with cubic vitreous silver ore, rhomboidal pearl spar, and transparent lenticular calcareous spar; on ferruginous quartz. *Freyberg.*

IX. *a* 3. The same, having a knitted appearance on one part of the surface. *Same place.*

X. *a* 4. Of a pale copper colour, ramifying through white ponderous spar, one surface polished. *Saxony.*

XI. *a* 5. The same, in reddish petrosilex. *Schneeberg.*

## VARIETY II. AMORPHOUS.

XII. *a* 1. Of a granular texture, with green oxyde of nickel, interspersed through white calcareous spar, covered on the surface by minutely crystallised yellow copper pyrites. *Cornwall.*

XIII. *b* 1. Of a compact texture and pale copper colour, intermixed with white ponderous spar, and partially covered by green oxyde of nickel. *Biber, Hoffe.*

XIV. *b* 2. More compact and of a finer grain, intermixed with a small proportion of grey ore of cobalt and white calcareous spar, cut and polished on two sides. *Same place.*

XV. *b* 3. Of a pale-copper colour, with crystallised grey cobalt ore and white quartz. *Schneeberg.*

XVI. *b* 4. Of the same colour and very solid, with minutely crystallised red silver ore on the surface. *Freyberg.*

XVII. *b* 5. Of the same colour, in white calcareous spar, intermixed with grey indurated clay. *Hartz.*

XVIII. *b* 6.

XVIII. *b* 6. In a very irregular mass, with green oxyde of nickel on the surface.

*Saxony.*

XIX. *b* 7. In a rounded compact nodule, of a pale copper colour.

*St. Marie aux Mines.*

XX. *b* 8. Portion of a larger nodule, with crystallised iron pyrites. *Same place.*

#### SPECIES IV. ARSENIATE OF NICKEL.

Lately discovered at *Regensdorf* by *Gmelin*, who describes it as occurring in amorphous masses of a pale grey colour intermixed with pale green, without lustre or transparency; its fracture compact and partly earthy, partly splintery; not very easily scratched with the knife; giving a white streak; of difficult frangibility; adhering slightly to the tongue, and giving an earthy smell when breathed on. It is soluble in the nitric and muriatic acids by the assistance of a strong heat, and affords green solutions which contain no copper, though they are changed to blue by the addition of ammoniac. *Gmelin* has found it to contain, Nickel in union with the Acid of Arsenic, some traces of Cobalt, a small proportion of Alumine, and sometimes of Baroselenite, with which in its natural state it is often intermixed.

#### VARIETY I. AMORPHOUS.

*a.* Compact.

#### GENUS III. ARSENIC.

*Arsenicum.* *Arsenic*, Fr. *Arsenik*, Germ.

This in its pure reguline state is of a bluish white colour, with metallic splendour, and of a foliated or scaly texture. By exposure to the air it becomes dullish yellow, and at length greyish black and pulverulent on the surface. It yields pretty readily to the knife, and is very brittle; its specific gravity 8.31. In close vessels it sublimes without alteration at 3.56 *Farenh.* but if exposed to air it burns with an alliaceous smell and blue flame, and is converted into a white oxyde (*Common Arsenic*), which is itself also capable of being volatilised. It is not easily acted on by acids; the oxymuriatic dissolves it most readily; the others, more especially the muriatic, require the assistance of heat. By boiling it may be combined with unctuous oils, and, by fusion, with sulphur and with most of the metals: those which are ductile it renders brittle, some it renders more fusible,

as platina, others less, as tin ; to the red and yellow metals it imparts a silvery whiteness, therefore, principally employed in the composition of certain metallic mixtures, as in the manufacture of shot and certain kinds of printers types. In the state of oxyde it is likewise employed in glass making, dying, the preparation of *Scheele's* green pigment, and in medicine. The ores of arsenic are,

### SPECIES I. NATIVE ARSENIC.

*Scherben Cobalt. Arsenic testacé, Born. Gediegen-Arsenick, Germ.*

The colour of this, when recently broken, is a light bluish grey intermediate between tin white and lead grey, but, like that of the artificial regulus, changing very soon to a yellow, and afterwards to a blackish grey and greyish black. It is seldom found in lumps, interspersed or in plates, and more rarely striated ; generally of particular shapes, as stalactitic, botryoidal, mammillated, &c. It is internally of a metallic splendour, externally dull. Its texture is compact, and generally more or less uneven, inclining to the conchoidal, sometimes striated, often composed of thick or thin curved or concentric layers. It is nearly of sufficient hardness to give fire with steel, and is in a certain degree malleable. When struck or rubbed it gives out a garlic smell. In its chemical properties it agrees pretty exactly with the pure metal, from which however it differs in containing a small proportion of Iron, and often of Silver and Gold. It is found only in veins in primitive mountains, accompanied by red silver ore, sulphuret of arsenic, galena, white cobalt ore, and other metallic substances, besides ponderous, calcareous, pearl and fluor spars and quartz, and principally in the mines of *Bohemia, Saxony, Alsace, the Hartz, Carinthia, Swabia, and Transylvania.*

#### I. Pure regulus of arsenic.

### VARIETY I. OF PARTICULAR SHAPES.

#### a. Stalactitic.

II. *b* 1. Of a very dull dark grey colour, botryoidal on the surface. *Geyer.*

III. *c* 1. Of a shining leaden grey colour, mammillated on the surface and composed of concentric layers, with white calcareous spar. *Hartz.*

### VARIETY

## VARIETY II. AMORPHOUS.

IV. *a* 1. Of a dark dull grey colour, composed of concentric layers with a loose nucleus at the centre, intermixed with splendid scaly galena. *Hartz.*

V. *a* 2. The same, intermixed with a small proportion of white silver ore. *Hartz.*

VI. *b* 1. Of a dull leaden colour and striated texture, having numerous indentations on the surface, with reddish brown blende and white quartz. *Andalusia.*

*c.* Compact.

*d.* Pulverulent.

## SPECIES II. NATIVE OXYDE OF ARSENIC.

*Arsenic oxydé*, Fr. *Natürlicher-Arsnikkalk*, Germ.

This occurs either in a powdery form, or more or less indurated, or crystallised on the surface or in the cavities of other ores of arsenic, cobalt, &c. Its colour is greenish, yellowish, reddish or snow white, or light smoke grey. When pulverulent or simply indurated, it is generally dull; but if crystallised, it is for the most part semitransparent and of a silky lustre. Its fracture either earthy, or fibrous, or tending to the foliated. Both the indurated and crystallised are brittle and easily scratched by the knife; specific gravity 3.706. It impresses on the tongue a sweetish subacid taste; is soluble in eighty parts of water at a temperature of 60°, and in fifteen of boiling water: it is also soluble in most of the acids, more especially in the muriatic and aqua regia, in both which it dissolves without effervescence: by treatment with the nitric it may itself be converted into an acid of a peculiar kind (*Acid of Arsenic*). Under the blow-pipe it burns, like the native regulus, with a blue flame, and is converted into a white smoke, having also a strong alliaceous odour. It effervesces violently with nitre and the fixed alkalis, and unites readily by fusion with sulphur and with all the metals which are capable of combining with its regulus. It is found in small quantities, in the forms above mentioned, in the mines of *Joachimsthal*, *Raschau*, *Riechelsdorf*, *Salzbna*, *Schmoltz*, &c.

## VARIETY I. CRYSTALLISED.

*a.* In truncated tetrahedral prisms.

VII. *b* 1. In delicate needle-like crystals, with minutely crystallised mispickel, lining irregular cavities in black argillaceous schistus. *Riechelsdorf*, *Hesse.*

G g

VIII. *b* 2.

VIII. *b* 2. In semitransparent white polyhedral crystals, on the surface of pieces of amorphous realgar. Same place.

## VARIETY II. AMORPHOUS.

IX. *a* 1. Of a white colour and efflorescent, on the surface of a ponderous argillite. Goslar.

## SPECIES III. SULPHURET OF ARSENIC.

*Oxide d' Arsenic sulfuré*, Fr. *Rauschgelb*, Germ.

By most authors this is distinguished into two kinds, the yellow and the red: the one (*Orpiment*, *Oxide d' Arsenic sulfuré jaune*, Fr. *Gelbes Rauschgelb*, Germ.) of different shades of gold, sulphur, lemon or orange yellow; the other (*Realgar*, *Oxide d' Arsenic sulfuré rouge*, Fr. *Rothes Rauschgelb*, Germ.) of an aurora, scarlet, carmine, or ruby red colour. They both occur either in lumps, disseminated or superficial, sometimes of particular shapes, and often crystallised, more especially the realgar, in tetrahedral rhomboidal prisms with corresponding pyramids and their modifications. The fracture of the yellow is foliated, of the red granular and uneven inclining to the conchoidal; their splendour unctuous or vitreous, in some instances approaching to that of the diamond. When crystallised or in thin folia semitransparent. They are both easily scratched by the knife, and give a yellowish streak. Specific gravity, according to *Briffon*, of the yellow 3.452, and of the red 3.338. Under the blow-pipe this ore melts, burns with a blue flame, and is dissipated in the form of a sulphureous arsenical smoke. It is soluble in aqua regia and by nitric acid the red is deprived of its colour, and though in general realgar has been considered as differing from orpiment in containing a larger proportion of sulphur, it appears by the experiments of *M. Boquet* that, when prepared artificially, the redness or yellowness of colour depends altogether on the application of a greater or less degree of heat. Orpiment is stated by *Emmerling* rather to belong to alluvial, and realgar to primitive mountains; the first associated with indurated clay, quartz, &c. in the *Bannat*, *Transylvania*, *Hungary*, *Wallachia*, *Natolia*, *Italy*, &c. the other with quartz, indurated clay, calcareous and ponderous spar, native arsenic, red silver ore, galena, &c. in the *Bannat*, *Bohemia*, *Hungary*, *Saxony*, the *Hartz* and the *Tyrol*, *Lothringia*, *Swabia*, *Transylvania*, *Italy*, &c.

## VARIETY



## VARIETY I. CRYSTALLISED.

X. *a* 1. In large tetrahedral rhomboidal prisms terminated by tetrahedral pyramids variously truncated, of a ruby red colour, and aggregated on ferruginous quartz.

*Hungary.*

XI. *a* 2. The same, having their pyramids truncated both at their apices and at all their angles, on compact grey blende with a tubercular quartz incrustation.

*R. de L. Pl. 7, Fig. 12.*

*Same place.*

XII. *a* 3. The same, more minutely crystallised, on the surface of an indurated stony substance incrustated with native white vitriol.

*Same place.*

XIII. *a* 4. In tetrahedral rhomboidal prisms terminated by tetrahedral pyramids, of a bright red colour and semitransparent, with scabrous crystals of opaque rhomboidal pearl spar, on grey opaque quartz intermixed with reddish ponderous spar.

*Felobanya.*

*R. de L. Pl. 7, Fig. 11.*

XIV. *a* 5. The same, in very minute and numerous crystals, with rhomboidal pearl spar, on granular native arsenic.

*Hungary.*

*b.* Indeterminate.

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Stalactitic.

## VARIETY III. AMORPHOUS.

XV. *a* 1. Of a foliated texture and lemon yellow colour (*Orpiment*) intermixed with red (*Realgar*).

*Hungary.*

XVI. *a* 2. Composed of parallel layers, of a bright ruby colour and very transparent.

*Same place.*

XVII. *b* 1. In a compact mass of a deep orange colour.

*Same place.*

XVIII. *b* 2. The same, of a lemon yellow colour, on an indurated spongy matrix having the appearance of lava.

*Same place.*

XIX. *c* 1. Of a granular texture and bright red colour, intermixed with dark grey quartz.

*Transylvania.*

- XX. c 2. The same, in a brownish indurated sandstone. *Hungary.*
- XXI. c 3. The same, in an indurated earthy matrix. *Same place.*
- XXII. d 1. In a pulverulent form, of a yellow colour, on the surface of crystallised pyramidal quartz. *Hungary.*

#### SPECIES IV. MISPICKEL.

*Arsenic pyriteux, Fr. Gemeiner Arsenikkies, Germ.*

The properties of this, which by many is ranked with the ores of iron, render it easily distinguishable from the other kinds of pyrites. It is found either in lumps, or interspersed, or crystallised in rhomboidal tetrahedral prisms with obtuse dihedral summits. Its colour silver or tin white, with metallic lustre, and inclining often to greyish, yellowish, or bluish, sometimes variegated. Its texture uneven, of a coarse or fine grain. When crystallised, the surface of its prisms is smooth, their summits indistinctly striated; its crystals projecting in various directions, often compressed, imbedded in each other or confusedly aggregated. It is opaque, brittle, gives fire with steel, emits a garlic odour upon friction and is very ponderous, its specific gravity being according to *Gellert* 5.753, to *Briffon* 6.522. Under the blow-pipe it gives out a white arsenical smoke, leaving behind a reddish brown ferruginous oxyde. It is soluble with effervescence both in the nitric and oxymuriatic acids; by further analysis it appears to consist of Arsenic in union with Iron, and a small proportion of Sulphur. This ore is considered by *Emmerling* as peculiar to primitive mountains, in which it occurs more commonly in beds than in veins, associated for the most part with native oxyde of tin, galena, blende, spathose iron ore, iron and copper pyrites, quartz, calcareous and pearl spar, and fluor, in the mines of *Bahemia, Saxony, Silesia, &c.*

A variety of this ore generally of a lighter colour and having less splendour, containing from one to ten per cent. of silver, and found principally accompanied with common mispickel, red silver ore, galena, copper pyrites, &c. in quartz or pearl spar, at *Braunsdorf* and *Freyberg* in *Saxony*, is described by *Werner* and others as a distinct species under the name of *Weiserz, Mispickelsilber, Germ. Arsenicum mineralisatum pyritaceum argentiferum, Wern. Argentiferous arsenical Pyrites, Kirm.*

#### VARIETY I. CRYSTALLISED.

- XXIII. a 1. In tetrahedral rhomboidal prisms with obtuse dihedral summits, of a steel

steel grey colour, projecting from the surface of amorphous grey mispickel intermixed with white quartz.

*Freyberg.*

*R. de L. Pl. 7, Fig. 10.*

XXIV. *a* 2. The same in smaller crystals, with transparent prismatic quartz, on a mixture of granulated mispickel and ash-coloured micaceous schistus.

*Saxony.*

XXV. *a* 3. In larger and shorter rhomboidal prisms, having the pyramids of both extremities completely truncated, also with transparent quartz, on a mixture of mispickel and blende.

*Freyberg.*

*R. de L. Pl. 7, Fig. 7, 4.*

XXVI. *a* 4. In still larger rhomboidal crystals, of a yellowish grey colour and scaly texture, with quartz, pearlspar, blende, galena, and yellow pyrites.

*Saxony.*

XXVII. *a* 5. Similar to the last, scabrous on the surface, in brown scaly blende with white prismatic quartz.

*Same place.*

XXVIII. *a* 6. The same, in smaller crystals, smooth on the surface, with minutely crystallised lenticular ponderous spar, on dark brown scaly blende.

*Braunsdorf.*

XXIX. *a* 7. In small shining rhombic crystals, dispersed through a dull grey spongy irregular mass of mispickel, on semitransparent white quartz.

*Freyberg.*

*b.* Indeterminate.

## VARIETY II. AMORPHOUS.

*a.* Granular.

XXX. *b* 1. Of a striated texture and silver white colour, with brown blende, yellow pyrites and white quartz.

*Cornwall.*

XXXI. *c* 1. Compact and of an angular fracture, without matrix.

*Same place.*

## GENUS.

## GENUS IV. COBALT.

*Cobaltum.* *Cobalt*, Fr. *Kobelt*, Germ.

When free from its general concomitants, arsenic, iron, and nickel, this semimetal is of a light or bluish grey colour, and of metallic splendour, if tarnished inclining to red ; its fracture compact, uneven, and of a fine grain ; nearly of sufficient hardness to give fire with steel ; brittle ; specific gravity according to *Briffon* 7.811 ; even when most pure, obedient to the magnet. It is almost as difficult of fusion as cast iron. In the open fire it is slowly converted into a very deep blue or black oxyde, which communicates a blue colour to glass of borax, to both the fixed alkalis and to microcosmic salt. In the sulphuric and marine acids it is only soluble by the assistance of heat ; the nitric and oxymuriatic acids dissolve it more readily, more especially the latter : in this its solution is of a reddish colour, and if diluted and used as an ink (*Sympathetic Ink*) possesses the property of changing to a blue colour, and if iron be present to a green on exposure to heat, and of becoming invisible when cold. It dissolves also in solution of ammoniac. Cobalt is understood to be capable of combining with all the other metallic substances, with the exception of silver, mercury, lead, and bismuth ; with zinc it unites with difficulty, with difficulty also with sulphur, but more readily with alkaline sulphurets. The chief uses of cobalt and its ores are, in glass-making, enamelling and painting. Its ores are,

## SPECIES I. GREY COBALT ORE.

*Cobalt arsenical*, Born. *Grauer-Speiskobelt*, Germ.

A variety in the proportion of their constituent parts, viz. Arsenic, Sulphur, and Iron, constitutes the chief difference between this, the sulphuret of cobalt (SPECIES IV.) and the white cobalt ore (SPECIES V.), or the *Grauer Speiskobelt*, *Weiser-Speiskobelt*, and *Glanzkobelt*, Germ. which pass into each other by insensible degrees. The grey is generally in its fresh fracture of a bright steel grey colour and metallic splendour, but upon exposure, becomes dull and greyish black or variegated. It occurs either in lumps, interspersed, or of particular forms, as dendritic, stalactitic, botryoidal, &c. or crystallised in smooth cubes and their modifications. Its fracture compact, more or less uneven and of a fine grain ; brittle ; of sufficient hardness to give fire with steel, and when struck exhales a strong arsenical smell ; specific gravity, according to *Kirwan*, from 5.309 to 5.511. In the nitric or oxymuriatic acid it dissolves with effervescence. Under the blow-pipe it gives out an arsenical smoke without fusing, but by means of glass of borax or black flux, it easily undergoes reduction and produces a dark blue slag. A specimen  
of

of this ore from *Cornwall*, analysed by *Klaproth*, contained Cobalt 20, Iron 24, Arsenic 33, the remainder Bismuth, with a small proportion of Sulphur. It is found frequently intermixed with and accompanied by the red oxyde and other ores of cobalt; often with kupfernickel, oxyde of nickel, and native bismuth; also with the ores of silver, copper, iron, lead, zinc and arsenic, in calcareous pearl or ponderous spars, fluor, quartz, hornstone, &c. and is principally obtained from the mines of *Saxony*, *Bohemia*, *Norway*, and *Sweden*.

#### VARIETY I. CRYSTALLISED.

- I. Pure cobalt, artificially crystallised on the surface.
- II. *a* 1. In smooth aggregated cubes truncated in both their angles and edges, of a steel grey colour, on compact grey cobalt intermixed with kupfernickel. *Schneeberg?*
- b*. Indeterminate.

#### VARIETY II. OF PARTICULAR SHAPES.

- III. *a* 1. Of a reticular structure and obscure grey colour, intermixed with minutely crystallised red silver ore. *Marienberg.*
- IV. *a* 2. The same, with a small proportion of ponderous spar. *Same place.*
- V. *a* 3. Of a knitted texture and dark steel grey colour, without any admixture. *Annaberg.*
- VI. *a* 4. The same, cut and polished. *Same place.*
- VII. *a* 5. The same, of a lighter colour, with capillary native silver, and intermixed with white ponderous spar. *Saxony.*
- VIII. *a* 6. Forming dendritic ramifications in flesh-coloured ponderous spar, with a small proportion of native silver. *Alva, Scotland.*
- IX. *b* 1. Of a light steel grey colour, partly arborescent, resembling the head of a cauliflower, and partly in aggregated cubes truncated, with arborescent kupfernickel. *Schneeberg.*
- X. *b* 2. Of a dark lead grey colour and compact texture, tuberculated on the surface and incrustated with red oxyde of cobalt. *Same place.*

#### VARIETY

## VARIETY III. AMORPHOUS.

XI. *a* 1. Of a laminated texture, the laminæ intersecting each other in various directions. *Schneeberg.*

XII. *b* 1. Of a granular texture and light steel grey colour, intermixed with whitish calcareous spar. *Sahlberg.*

XIII. *b* 2. Of a fine steel grained compact texture, incrustated on one side by whitish pyramidal quartz. *Schneeberg.*

*c.* Compact.

## SPECIES II. NATIVE OXYDE OF COBALT.

*Oxide ou Chaux de Cobalt, Fr. Schwarzer-Brauner-und Gelber-Erdkobelt, Schwarzer-Kobeltmuhl, Germ.*

The oxyde of cobalt, like the oxydes of most of the other metallic bodies, occurs either in a powdery form or of different degrees of induration, and of different colours; hence divided by *Werner* and others into different families, viz. 1st. brownish, bluish, or greyish black, 2d. liver brown, 3d. straw or greyish yellow. It is found either superficial, interspersed, or in lumps; sometimes botryoidal or reniform or bearing particular impressions. The indurated has an earthy fracture and is dull, but becomes more splendid by the streak; so soft as generally to soil the fingers; specific gravity of the black, according to *Kirwan*, from 3 to 4, sometimes lower. Under the blowpipe it generally gives out a slight arsenical smell, but is infusible *per se*. To glass of borax it imparts a beautiful blue colour, and is sometimes in part reduced. A variety of the black from *Schneeberg* is stated by *Mr. Kirwan* to be soluble both in the nitric and muriatic acids, giving with the former a reddish, with the latter, a bluish green solution. The associates of this ore, the constituent parts of which have not as yet been accurately ascertained, are, iron ochre, iron pyrites, arseniate of cobalt and also oxyde of nickel, silver and copper ores with quartz, ponderous and calcareous spars, indurated clay, &c. It is met with as well in primitive as in alluvial mountains, and principally at *Schneeberg* and *Kamisdorf* in Saxony, at *Saalfeld* in Thuringia, at *Alpierspach* and *Reinerzau* in the duchy of *Wurtemberg*, at *Wittichen* in the principality of *Furstenberg*, at *Kitzbichel* in the Tyrol, and at *Allemont* in Dauphiné.

## VARIETY I. OF PARTICULAR SHAPES.

*a.* Botryoidal.

*b.* Reniform.

## VARIETY II. AMORPHOUS.

XIV. *a aa* 1. Of a dark blue colour, and friable earthy texture. *Schneeberg.*

XV. *a aa* 2. The same, of an indurated spongy texture, intermixed with yellow ochre and pale green oxyde of nickel. *Same place.*

XVI. *a bb* 1. Of a black colour and indurated, with plated ponderous spar. *Biber, Hesse.*

XVII. *a bb* 2. The same, without matrix, having a greenish yellow incrustation on the surface. *Dauphiné.*

XVIII. *a bb* 3. Of a bluish black colour in whitish ponderous spar. *Biber.*

XIX. *a bb* 4. Of a blackish colour, intermixed with arsenate of cobalt, in yellowish fuber-montanum. *Jobngeorgenstadt.*

XX. *a bb* 5. Of a black colour and indurated, containing native silver with arseniate of cobalt. *Dauphiné.*

XXI. *a bb* 6. The same, of a slaty texture. *Schneeberg.*

XXII. *a bb* 7. The same, in a powdery form, having the appearance of lamp-black. *Same place.*

XXIII. *a cc* 1. Of a liver brown colour and indurated earthy texture. *Saalfeld.*

XXIV. *a cc* 2. In a sandy form, of a brown colour and somewhat sparkling. *Same place, or Schneeberg.*

## SPECIES III. ARSENIATE OF COBALT.

*Fleurs de Cobalt*, Fr. *Rotber-Erdkobelt*, Germ.

Arseniate of cobalt, commonly called *Cobalt Bloom*, occurs for the most part either as a covering to, or intermixed with other cobalt ores (*Kobaltbeschlag*, Germ.); or crystal-

H h

lised

lified in tetrahedral prisms terminated by dihedral pyramids having rhombic faces (*Kobeltblüte*). Its colour pale or deep peach bloom. When amorphous it is dull, and of an earthy fracture; when crystallised, more or less transparent, and of a striated or foliated fracture; its crystals small, and generally diverging: in both cases it is capable of being easily scratched by the knife, sometimes by the nail. Before the blow-pipe it emits a weak arsenical smell, becomes of a blackish grey colour without fusing, but to glass of borax communicates a fine blue colour. The Arsenic which it contains is justly considered as united in a state of Acid with the Oxyde of Cobalt. It is most commonly met with in the same mines which produce the native oxyde, and accompanied with nearly similar substances.

#### VARIETY I. CRYSTALLISED.

a. In tetrahedral prisms terminated by dihedral pyramids having rhombic faces.

XXV. *b* 1. In semitransparent short prisms, diverging from a common centre and of a pale red colour, forming numerous stellæ in ochry indurated clay.

*Catal. de Raab.* 5 D. a. *b.* 4.

*Schmolnitz, Hungary.*

#### VARIETY II. AMORPHOUS.

XXVI. *a* 1. Of a peach bloom colour, forming small tubercles on plated ponderous spar. *Saalfeld.*

XXVII. *a* 2. Forming a spongy incrustation, of a pale peach bloom colour, on agglutinated schist. *Schneeberg.*

XXVIII. *a* 3. In small tubercles, of a peach bloom colour, on a mixture of quartz and ash-coloured indurated clay. *Saalfeld.*

XXIX. *a* 4. The same, on brownish spongy clay. *Same place.*

XXX. *a* 5. The same, with pale green efflorescing oxyde of nickel on the surface. *Cornwall.*

XXXI. *a* 6. The same, on decomposing grey cobalt ore, with a brownish and ash-coloured efflorescence on the surface. *Alva, Scotland.*

XXXII. *a* 7. In a compact mass, intermixed with white ponderous spar. *Saalfeld.*

XXXIII. *a* 8.



XXXIII. *a* 8. Incrusting the surface of an irregular agglutinated mass of black oxyde of cobalt and white indurated clay. *Biber.*

XXXIV. *a* 9. Intermixed with green and blue carbonate of copper, and white plated ponderous spar, on decomposing grey cobalt ore. *Saalfeld.*

XXXV. *a* 10. Intermixed with green carbonate of copper, on grey cobalt ore. *Same place.*

*b.* Efflorescent.

#### SPECIES IV. SULPHURET OF COBALT.

*Cobalt sulphuré*, Born. *Glanzkobelt*, Germ?

*Baron Born* states this to be entirely devoid both of arsenic and iron, though in its external characters very analogous to the white cobalt ore. (SPECIES V.) He describes it as being, either amorphous or crystallised, in cubes and their modifications; of a whitish colour and granular texture; much disposed to tarnish and assume a steel grey colour on exposure to the air; as giving fire difficultly with steel, and on the application of heat emitting a sulphureous vapour free from any arsenical smell. The only specimens he mentions are from *Kegel* at *Schmolnitz* in *Upper Hungary*, and from *Joachimsthal* in *Bohemia*; the first employed at *Gloknitz* in the preparation of the finest kind of smalt. Vide *Catal. de Raab*. Tom. 2. P. 183, 184.

#### VARIETY I. CRYSTALLISED.

XXXVI. *a* 1. In small distinct smooth cubes, of a dull steel grey colour, imbedded in dark grey quartz with native bismuth on the surface. *Schneeberg.*

XXXVII. *a* 2. In smaller cubes, with native bismuth, both superficial and interspersed. *Joachimsthal.*

*b.* Indeterminate.

#### VARIETY II. AMORPHOUS.

*a.* Granular.

*b.* Compact.

## SPECIES V. WHITE COBALT ORE.

*Cobalt blanc*, Fr. *Weisser-Spießkobelt*, Germ.

The composition of this appears to be intermediate between that of the grey ore and the sulphuret: like these it is found either amorphous or interspersed, or of particular shapes, or more or less distinctly crystallised; the figure of its crystals, the cube and its modifications, their surface sometimes striated; its colour tin white, inclining, on exposure, to yellow, red, or grey, sometimes variegated; its lustre metallic; its texture compact, uneven, and granular, sometimes laminated; almost always of sufficient hardness to give fire with steel; very ponderous and brittle. It dissolves with effervescence both in the nitric and oxymuriatic acids. Under the blow-pipe it melts with more or less facility according to the proportion of arsenic, and on exposure to a gradual heat emits at first an arsenical and afterwards a sulphureous vapour, leaving behind a greyish oxyde, by which, according to the proportion of iron, a more or less perfect blue colour is communicated to glass of borax. The associates of this ore are nearly similar to those of the grey. In *Saxony* and *Norway*, it is met with in micaceous schistus, at *Tunaberg* in *Sweden* in large and detached crystals.

## VARIETY I. CRYSTALLISED.

XXXVIII. *a* 1. In large cubes truncated in their angles, of a tin white colour, smooth and splendid, with white opake calcareous spar. *Hartz.*

XXXIX. *a* 2. The same, in ash-coloured indurated clay with quartz. *St. Marie aux Mines.*

XL. *a* 3. In small cubes, also truncated at their solid angles, of a perfect tin white colour and very splendid, imbedded in white calcareous spar. *Schneeberg.*

XLI. *a* 4. In large detached cubes, of a reddish white colour, striated on the surface, and bevelled at all their edges. *Tunaberg, Sweden.*  
*R. de L. Pl. 2, Fig. 8.*

XLII. *a* 5. In large distinct cubes, imbedded in fat quartz, with yellow copper ore. *Norway.*

XLIII. *a* 6. In aggregated cubes having their solid angles deeply truncated, with white ponderous spar, on grey schistus, *Biber, in Hesse.*

XLIV. *a* 7.

XLIV. *a* 7. In small cubes variously truncated, and irregularly aggregated into branches, partly incrustated with transparent crystallised quartz and crystallised calcareous spar. *Saxony.*

*b.* Indeterminate.

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Reniform.

## VARIETY III. AMORPHOUS.

XLV. *a* 1. Of a granular texture and reddish white colour, intermixed with black mica. *Norway.*

LXVI. *a* 2. The same, with a smaller proportion of mica, polished on the surface. *Kongsberg.*

XLVII. *b* 1. In a thin layer and specular on the surface, lying on white quartz. *Biber, in Hesse.*

## GENUS V. ZINC.

*Zincum.* Zinc, Fr. *Zink,* Germ.

Zinc is a semimetal of a light bluish or tin white colour, with common metallic lustre; when tarnished inclining to a leaden grey, though comparatively but little subject to alteration on exposure to the air. Its texture is broad striated, passing into foliated. It bears the impression of the hammer, and may even by compression be squeezed into thin plates. Its specific gravity, in its common form, is, according to *Bergman*, 6.862, when pure and compressed 7.190, according to *Briffon*.

The effects of heat upon zinc are more remarkable than upon most other metallic bodies; for though in a certain degree malleable when cold, if heated it becomes so brittle as to be reducible into powder. It melts at about 700 *Farenh.* and in close vessels sublimes unchanged, but in contact with air it burns with a luminous greenish and somewhat bluish white flame, and is converted into a flocculent oxyde (*Flowers of Zinc*) vitrifiable by a more intense heat into a yellowish glass. It is more or less soluble in all the acids, and has for them such an attraction, as enables it to decompose most of the other metallic solutions. With the sulphuric acid it produces the common *White Vitriol, Salt* or *Sulphate of Zinc*. Almost equally general is its disposition to unite with the other metals, nickel and bismuth being the only ones with which it cannot be combined by fusion. With iron and cobalt it unites with more difficulty than with the rest. It renders these, and all the others with which it is capable of combining, brittle and

and more volatile; and to such as melt with difficulty it also communicates a degree of fusibility. The brittleness which it occasions is however least remarkable in its union with tin and lead. To copper it imparts a golden yellow colour, as in the preparation of *Brass*. With quicksilver it amalgamates with such facility as to be separable by it not only from copper, but from many of its other metallic mixtures.—From these it may be also easily freed by means of sulphur, with which in no proportion nor in any way is it capable of being combined. The chief uses of this semimetal are, in the composition of brass, pinchbeck, princes-metal, tombac, tinsel, electrical amalgam, &c. and in certain medicinal preparations. Its ores are,

### SPECIES I. NATIVE OXYDE OF ZINC.

*Calamine.* *Calamine*, Fr. *Gemeiner-Galmei*, Germ.

The colour of calamine varies according to the proportion of oxyde of iron with which it is intermixed, and is therefore generally yellowish, greyish, or reddish white, ochry or orange yellow, or yellowish brown, sometimes yellowish, smoke or ash-grey; when pure it is white; many of these colours are often met with in the same specimen. Although for the most part found in lumps and interspersed, it very frequently also occurs superficial, cellular, or of particular shapes, as botryoidal, stalactitic, or forming secondary crystals by having supplanted calcareous spars, fluors, &c. It is without lustre, and opaque. When indurated its fracture is either earthy or compact, uneven, and of a fine grain, sometimes fissile; seldom of sufficient hardness to give fire with steel; specific gravity, according to *Born*, from 4.4 to 5; according to *Kirwan* of one specimen 2.585, of another 4.019. It dissolves both in the vitriolic and nitric acids, and sometimes with effervescence. Before the blow-pipe it decrepitates if suddenly heated, and becomes of a lighter colour, but resists fusion. By the experiments of *Margraff*, it yields from  $\frac{1}{4}$  to  $\frac{1}{3}$  its weight of Zinc; by *Bergman* from 100 parts of best prepared calamine were obtained, Oxyde of Zinc 84, Oxyde of Iron 3, Silex 12, Alumine 1. Such as does not contain at least 30 per cent. of zinc is in the opinion of *Baron Born* unfit to be employed in the manufacture of brass. Calamine is met with in *Bohemia*, *Poland*, *Westphalia*, *Carintia*, and many other parts; and in great abundance in *Derbyshire*, *Cumberland*, *Northumberland*, and several of the other counties of *Great Britain*, associated with iron ochre, brown hematite, galena, spathose lead ore, calcareous spar, fluor, indurated clay, &c.

I. Pure regulus of zinc.

VARIETY

## VARIETY I. OF PARTICULAR SHAPES.

II. *a* 1. Supplanting aggregated crystals of double pyramidal calcareous spar, hollow, cellular, and ochry, on the surface of cubic fluor. *Derbyshire.*

III. *a* 2. Supplanting aggregated cubes of fluuate of lime, on an irregular compact mass of the same, intermixed with galena. *Same place.*

IV. *a* 3. Supplanting trihedral pyramids of calcareous spar, of a light brown colour, and internally cellular. *Wales.*

V. *a* 4. In large pyramidal crystals of the same, of an obscure greenish yellow colour, internally cellular and ochry. *Same place.*

VI. *a* 5. In aggregated indeterminate crystals, of a dull white colour and ochry on the surface, forming numerous ramifications on opaque grey quartz. *Pyrenees.*

VII. *b* 1. In short stalactites, of a spongy texture and light brown colour, becoming dark on exposure, and incrustated with pale yellow pyrites. *Aix la Chapelle.*

VIII. *b* 2. Of a brownish yellow colour and cellular texture, having the surface covered by a mammillated incrustation of the same. *Derbyshire.*

IX. *b* 3. Of a paler colour, compact, semitransparent, and mammillated on the surface. *Same place.*

X. *b* 4. Of a still paler colour, cavernous structure, and having smaller mammillæ. *Same place.*

XI. *b* 5. Of a pale sky-blue colour, having the texture of porcelain, botryoidal on the surface, and in part covered by a brownish incrustation. *Wanlockhead, Dumfries.*

XII. *b* 6. In a ponderous cavernous mass, of a greenish yellow colour, having its cavities lined with numerous mammillæ. *South Wales.*

XIII. *b* 7. Of a reddish yellow colour, forming a compact tuberculated incrustation on amethystine fluor. *Same place.*

XIV. *b* 8. Forming a tubercular incrustation, partly white, partly light brown, on the surface of decomposing fluor. *Same place.*

XV. *b* 9. The same, of an ochry yellow colour.

*Derbyshire.*

VARIETY

## VARIETY II. AMORPHOUS.

- XVI. *a* 1. Of a dull reddish white ash-colour, indurated and of an earthy texture.  
*Carinthia.*
- XVII. *a* 2. The same, of a white colour, resembling chalk. *Bavaria.*
- XVIII. *a* 3. The same, on brownish indurated clay. *Carinthia.*
- XIX. *b* 1. Of an ochry colour and spongy texture, intermixed with brown blende.  
*Spain.*
- XX. *b* 2. Of a reddish brown colour and more spongy texture, formed on red calcareous spar. *France.*
- XXI. *b* 3. Of a brownish ochry colour, and cellular texture. *Germany.*
- XXII. *b* 4. Of an ochry yellow colour and cellular structure, on the surface of confusedly crystallised calcareous spar. *Derbyshire.*
- c.* Friable.

## SPECIES II. CARBONATE OF ZINC.

*Zinc spatbique*, Fr. *Zinkspath*, Germ. *Blättriger-Galmey*, Karsten.

This, in proportion to its purity, is more or less white and transparent; commonly however its colour is yellowish grey, passing into the yellowish white, Isabella or ochry yellow, sometimes greenish or bluish white. It is found in lumps, or interspersed; more frequently however of particular shapes, as mammillated or reniform; or crystallised in compressed hexedral prisms with dihedral summits, or in quadrangular tables and their modifications, the crystals commonly more or less aggregated, and often diverging. It has generally a mother-of-pearl splendour; its fracture radiated, inclining to the foliated; sometimes of sufficient hardness to give fire with steel; brittle; specific gravity of the greenish grey crystals according to *Briffon* 3.523. Under the blow-pipe it loses its colour, but is neither fusible *per se* nor with the addition of borax. By calcination it loses about  $\frac{1}{3}$  of its weight. With the mineral acids, in which it effervesces, it becomes gelatinous, and hence was formerly mistaken for zeolite. According to *Bergman* a specimen of this ore from *Helywell* in *Flintshire*, contained Oxyde of Zinc (with perhaps a little Iron) 65, in another from the same place *Margraaf* found 60 per cent. of the Oxyde, Carbonic Acid 28, Water 6; a striated mass examined by *Pelletier* yielded

Carbonate

Carbonate of Zinc 36, Silica 48.52, Water 8.12. It is found principally at *Bleiberg* and *Raibell* in *Carinthia*, at *Hofsgrund* near *Freyberg* in the *Brigau*, at *Tirmitz* in *Stiria*, &c.

#### VARIETY I. CRYSTALLISED.

XXIII. *a* 1. In numerous slender, converging and somewhat flattened hexedral prisms with dihedral summits, transparent and of a pearly lustre, covering the surface of an irregular compact mass of carbonate of zinc (*Zeolitiform, Zinc ore*). *Fribourg, Brigau.*

XXIV. *b* 1. In transparent oblong quadrangular tabular crystals, bevelled at their edges and angles, on whitish ochry calamine. *Transylvania.*

*Catal. de Raab. IV. C. b. 2.*

XXV. *b* 2. The same, irregularly aggregated and extended on the surface of yellowish ochry calamine. *Carinthia.*

*c.* Indeterminate.

#### VARIETY II. OF PARTICULAR SHAPES.

XXVI. *a* 1. Forming a semitransparent yellowish white mammillated incrustation, of a radiated texture, on cellular ochry calamine. *Carinthia.*

XXVII. *a* 2. The same, on decomposing red copper ore. *Transylvania.*

XXVIII. *a* 3. In small crystals, aggregated into irregular tubercles. *Carinthia.*

XXIX. *a* 4. The same, lining a cavity in yellowish ochry calamine. *Brittany.*

#### SPECIES III. SULPHATE OF ZINC.

*Sulphate ou Vitriol de Zinc, Fr. Zinkvitriol, Germ.*

Native sulphate of zinc is generally met with either efflorescent or capillary, or in the form of small stalactites, and of a white, grey, yellow, or reddish white colour, and strongly styptic taste. When artificially crystallised, it assumes the form of rhomboidal prisms terminated by tetrahedral pyramids, soluble in about twice their weight of common water, and slowly efflorescent on exposure to the air. In this state a hundred parts contain, according to *Born*, Zinc 20, Sulphuric Acid 22, Water 58; according to *Kirwan*, Oxide of Zinc 20, Metallic Zinc 26.4, Acid 12, Water 40; and according to

*Bergman*, Zinc 20, Acid 40, Water 40. The native sulphate contains always a certain proportion both of Oxyde of Iron and of Copper. Under the blow-pipe it effervesces, but without becoming luminous; it effervesces also with borax, microcosmic salt, and the fixed alkalis. It occurs in the zinc mines of the *Black Forest*, *Sweden*, *Bobemia*, *Austria* and *Hungary*, and is probably in most instances the result of the decomposition of certain kinds of pyrites.

#### VARIETY I. CRYSTALLISED.

- a. In rhomboidal prisms with tetrahedral pyramids.
- b. Indeterminate.

#### VARIETY II. OF PARTICULAR SHAPES.

- a. Stalactitic.

#### SPECIES IV. BLENDE.

*Blende*, *Sulphure de Zinc*, Fr. *Blende*, Germ.

By Mr. *Werner* and other German authors this ore is distinguished into three species, viz. *Gelbe-braune-und schwarze Blende*, its colour being generally of different shades of yellow, brown, and black; as sulphur, honey, or wax yellow, inclining often to yellowish green, or grey; yellowish or reddish brown, or blood red; or dark or brownish black: these colours, however, pass continually into each other by insensible degrees, and in the other properties of these different kinds of blende there is no important difference. It occurs either in lumps, interspersed, or crystallised, and generally in tetrahedrons or octohedrons and their modifications. Its crystals are seldom distinct, on the contrary, for the most part, very confusedly aggregated; their surface generally specular, internally approaching to the vitreous or even diamond splendour. When crystallised it is generally more or less transparent in proportion to the lightness of its colour. Its texture is always foliated; hardness not sufficient to give fire with steel; when scraped with the knife giving a lighter coloured streak and sulphureous smell, and sometimes, more especially the yellow, becoming phosphorescent when rubbed in the dark. It is brittle; specific gravity from 3.770 to 4.067. By *Bergman's* analysis a specimen of the yellow phosphorescent blende from *Scharfenberg* in *Saxony* yielded Zinc 64, Sulphur 20, Iron 5, Acid of Fluor 4, Silica 1, Water 6; another of a reddish brown colour from *Sahlberg* in *Sweden*, Zinc 44, Sulphur 17, Iron 5, Silica 24, Alumina 5, Water 5; and a third



of a black colour from *Dannemora*, Zinc 45, Sulphur 29, Iron 9, Lead 6, Arsenic 1, Silica 4, Water 6. The greater part of it is soluble in the nitric acid, much nitrous gas being evolved and the sulphur remaining behind. The acids are said by *Kirwan* to act on the black blende with effervescence, while the others are slowly soluble and do but slightly effervesce unless heat be employed. Under the blow-pipe this ore decrepitates, emits a whitish smoke, but does not melt either *per se* or with glass of borax; by a continuance of the heat it is converted into a greyish oxide. It is generally found associated with galena, grey copper ore, pyrites, or native, vitreous and other silver ores, in a matrix of quartz, calcareous, pearl and fluor spar, at *Freyberg* and *Scharfenberg* in *Saxony*, at *Sahlberg* and *Dannemora* in *Sweden*, at *Schemnitz* and *Kremnitz* in *Hungary*, at *Ratiborfchitz*, *Kuttenberg* and *Przibram* in *Bohemia*; at *Stollberg* and *Klausthal* in the *Hartz*; and also in the mines of *Upper* and *Lower Hungary*, *Transylvania*, *Norway*, &c. and very abundantly in *Cornwall*, *Derbyshire*, *Northumberland*, *Cumberland*, and various other parts of *Great Britain*.

#### VARIETY I. CRYSTALLISED.

XXX. *a* 1. In tetrahedrons of a black colour, with transparent prismatic quartz, on chlorite intermixed with yellow copper ore. *Cornwall*.

XXXI. *a* 2. In smaller tetrahedrons of a dull lead colour, with longer prismatic quartz on white quartz, intermixed with pyrites. *Same place*.

XXXII. *a* 3. In large brilliant crystals deeply truncated at their summits, of a yellowish brown colour, irregularly aggregated and partially coated by minute crystals of prismatic quartz. *Bohemia*.

XXXIII. *a* 4. In a large splendid solitary crystal truncated at the apex, enclosed in transparent crystallised quartz. *Hartz*.

XXXIV. *a* 5. In aggregated tetrahedrons, of a blackish brown colour, deeply truncated at all their solid angles. *Cornwall*.

*R. de L. Pl. 1, Fig. 2.*

XXXV. *a* 6. The same, of a lighter brown colour, on yellow copper ore. *Hartz*.

XXXVI. *a* 7. The same, in large splendid crystals, of a dark reddish brown colour, semitransparent and irregular, aggregated on brownish rhombic spathose iron ore. *Saxony*.

XXXVII. *b* 1. In large aggregated octohedrons, of a dark brown colour and iridescent

descent on the surface, on galena, with minutely crystallised quartz and yellow pyrites.

*Transylvania.*

XXXVIII. *b* 2. In aggregated octohedrons truncated at all their solid angles, with prismatic mispickel.

*Meissen.*

*R. de L. Pl. 3, Fig. 4.*

XXXIX. *b* 3. The same, in very brilliant crystals of a dark yellowish brown colour, on crystallised tuberos yellow copper ore, with cubic galena.

*Kapnic, Transylvania.*

XL. *b* 4. The same, with cubic crystals of galena, covered with a quartz in-crustation, on crystallised quartz mixed with galena and blende.

*Hartz.*

XLI. *b* 5. In large cuneiform octohedrons truncated in their angles, incrustated with minutely crystallised yellow pyrites and quartz, on an amorphous mass of blende of a black colour and somewhat iridescent.

*Bannat.*

*R. de L. Pl. 3, Fig. 5.*

XLII. *b* 6. Of a light brownish yellow colour and lamellar texture, in octohedral pyramids joined base to base and terminated obtusely by tetrahedral summits, forming crystals of 24 sides, with yellow cubic pyrites, on blende of the same kind.

*R. de L. Pl. 4, Fig. 110.*

*Schneeberg.*

XLIII. *b* 7. In large aggregated resin-like transparent polyhedral crystals, having 24 convex faces, with crystallised quartz, on grey indurated schistus.

*Hartz.*

*R. de L. Pl. 1, Fig. 29.*

XLIV. *b* 8. The same, in large reddish brown crystals, partially incrustated with minutely crystallised quartz.

*Hungary.*

XLV. *c* 1. In fragments of a light greenish yellow colour, on ochry calamine intermixed with brown blende.

*Auvergne.*

XLVI. *c* 2. In indeterminate crystals, of a brownish yellow colour inclining to red, with chrySTALLISED calcareous spar, on grey limestone.

*Brittany.*

XLVII. *c* 3. In polyhedral crystals, black, splendid and confusedly aggregated, with minutely crystallised yellow pyrites, on grey argillaceous quartz.

*Alston Moor, Cumberland.*

XLVIII. *c* 4. The same, with rhomboidal pearl spar and cubic yellow pyrites, on a similar matrix.

*Same place.*

XLIX. *c* 5.

XLIX. *c* 5. The same, on a layer of transparent crystallised quartz. *Same place.*

L. *c* 6. The same, with transparent purple cubic fluor, on impure grey quartz.  
*Same place.*

LI. *c* 7. Fragment of a large transparent crystal, of a brownish yellow colour and laminated texture. *Bobemia.*

*Catal. de Raab. IV. A. a. b. 7.*

## VARIETY II. AMORPHOUS.

LII. *a* 1. Of a foliated texture and reddish yellow colour, mammillated and covered by an incrustation of striated yellow pyrites superficially variegated, on grey indurated clay intermixed with white quartz. *Hungary.*

LIII. *a* 2. The same, of a pale brown colour, intermixed with purple fluor, on a layer of grey iron ore. *Lorraine.*

LIV. *a* 3. The same, of a reddish brown colour, intermixed with white quartz. *Staffordshire.*

LV. *a* 4. The same, in larger scales and variegated on the surface, with white quartz, spathose iron ore and yellow pyrites. *Joachimsthal.*

LVI. *a* 5. Of a scaly texture and reddish brown colour, intermixed with grey silver ore, yellow pyrites and galena, in ash-coloured sand stone. *Scharfenberg.*

LVII. *a* 6. The same, of a reddish brown colour variegated with blue and purple, with veins of white quartz. *Paris Mine, Anglesea.*

LVIII. *a* 7. The same, enclosing a vein of transparent gypsum and said to be rich in gold. *Bobemia.*

LIX. *a* 8. Of a large scaly texture and yellowish brown colour, with quartz and galena. *Altenberg.*

LX. *a* 9. The same, with grey silver ore and yellow pyrites. *Scharfenberg.*

LXI. *a* 10. The same, with galena and yellow pyrites, in opaque whitish quartz. *China.*

LXII. *a* 11.

LXII. *a* 11. The same, of a reddish brown colour, having the surface variegated green and purple, and rendered irregular by numerous crystalline impressions.

LXIII. *a* 12. Of a brownish black colour and compact scaly texture, shining and striated on the surface, without matrix. *Hartz.*

LXIV. *a* 13. In large scales, of a reddish brown colour, with white quartz. *Same place.*

LXV. *a* 14. Forming shining striæ of a greyish brown colour in ash-coloured indurated clay.

LXVI. *a* 15. In small scales having a granular appearance, intermixed with reddish white feldspar. *Hungary.*

LXVII. *a* 16. Of a scaly texture and brownish red colour, with galena, imbedded in white calcareous spar.

LXVIII. *a* 17. In large laminæ, of a bright leaden colour, variously aggregated and converging towards different centres, having on the surface somewhat of a cockscomb appearance, with reddish indurated clay.

#### GENUS VI. *ANTIMONY.*

*Antimonium. Antimoine, Fr. Spieglas, Germ.*

Regulus of antimony is of a brilliant tin, or rather silver white colour, of a foliated or scaly texture and very brittle. Its hardness such as to admit of being pretty easily scratched by the knife; specific gravity from 6.624 to 6.860. It melts at about 810 of *Farenh.* and if allowed to cool slowly, (from its disposition to crystallise) exhibits a stellated appearance on the surface. In close vessels it sublimes unchanged; when exposed in the open fire to a melting heat, it rises in a white smoke, which under condensation assumes the form of delicate needles; by calcination it is readily converted into a greyish oxyde, which being vitrified produces a glass of a pale hyacinthine colour. It dissolves most easily in the oxymuriatic acid, the sulphuric and muriatic require the assistance of heat, and by the nitric it is corroded or changed, by the rapid decomposition of the acid, into a white insoluble oxyde. It combines with all the other metallic substances without exception, rendering some of them more brittle and some harder: it amalgamates difficultly however with quicksilver, and destroys the magnetic property of iron. With sulphur it unites easily in all proportions, producing with it

it a grey striated compound (*Common or Crude Antimony*) of the shops. It is employed in the composition of printers types and other metallic mixtures, but principally as the basis of many important medical preparations.

### SPECIES I. NATIVE ANTIMONY.

*Antimoine natif*, Fr. *Gediegen-Speisglas*, Germ.

*Mr. Kirwan* follows the German mineralogists in considering this and the following species as of the same family : they differ however in the important circumstance, that with the one there is a certain proportion of arsenic, which the other is entirely free from. The species here described was first discovered in the year 1748 by the celebrated *Swab* at *Salberg* in *Carls Ort*, *Sweden*, and is found either in lumps or interspersed, of a tin white colour, metallic lustre, and foliated or striated texture. Upon exposure to the air it becomes superficially tarnished. It is easily scratched by the knife, is brittle and of considerable weight. Before the blow-pipe it fuses easily, and is converted into a white vitrifiable oxyde. It is totally soluble in *Aqua Regia*, and amalgamates readily with mercury. It has hitherto only been found in the place above mentioned in a matrix of calcareous spar or limestone.

I. Pure regulus of antimony artificially crystallised.

### VARIETY I. AMORPHOUS.

II. *a* 1. Of a tin white colour, interspersed through striated grey antimonial ore.  
*Magellan's Cronstedt*, Var. 2, Pag. 793. *Salberg*.

### SPECIES II. NATIVE ARSENICAL ANTIMONY.

*Antimoine arsenical*, Fr.

The external characters of this, for the discovery of which we are indebted to *Mr. Schreiber*, very nearly correspond with those of the foregoing, being of a tin white colour, metallic lustre, foliated texture, yielding readily to the knife, and ponderous. It occurs also in lumps or interspersed, sometimes reniform or mammillated. Under the blow-pipe it fuses easily, emits an arsenical odour, and like the other, is converted into a white vitrifiable oxyde. *Mr. Sage* states the Antimony in this ore to be alloyed with 16 per cent. of Arsenic ; but according to the opinion of *Mongez Junr.* the Arsenic contained in it seldom exceeds 3 per cent., and is rather to be considered as accidentally intermixed, than in a state of chemical combination. It is found in the mountain of *Chalances* at *Allemont*.

*Allemont* in *Dauphiné*, associated with grey, white and red antimonial ores, white cobalt ore, &c.

VARIETY I. OF PARTICULAR SHAPES.

a. Reniform.

III. *b* 1. Of a silver white colour and very brilliant, composed of concentric conchoidal layers mammillated on the surface. *Allemont*.

VARIETY II. AMORPHOUS.

a. Foliated.

SPECIES III. NATIVE OXYDE OF ANTIMONY.

*Antimonial Oebre*, Kirw. *Oxide d'Antimoine*, Fr. *Spiegelglasker*, Germ.

Is generally of a straw or lemon yellow colour, sometimes yellowish or reddish brown. It is found occasionally in lumps or interspersed, but for the most part as a covering to other antimonial ores, more especially the grey. It is without lustre, semi-indurated, and of an earthy texture. Before the blow-pipe it sublimes without fusion in the form of a white smoke; with glass of borax it effervesces strongly, and is partially reduced. The grey antimonial ore, with which it most frequently occurs, is that of *Braunsdorf* near *Freyberg*, and of *Hungary*. The white acicular crystals discovered by *Mongez Junr.* at *Cbalances* in *Dauphiné*, which he calls *Cbaux d'Antimoine native*, and of which he has given an account in the *Journ. de Physiq.* 1783, *Tom.* 23, *P.* 66, are now generally understood to be a variety of the native muriate of Antimony, SPECIES IV.

VARIETY I. AMORPHOUS.

a. Superficial.

b. Interspersed.

c. Earthy.

SPECIES



## SPECIES IV. MURIATE OF ANTIMONY.

*Muriate d'Antimoine*, Fr. *Weiss-Spießglaserz*, Germ.

This very rare ore of antimony, discovered by *Roseler* in 1787, is for the most part superficial; and occurs either in stellated acicular needles, or more frequently in rectangular tetrahedral laminæ, of a white colour, semitransparent, and of a diamond or mother of pearl lustre; the laminæ often set edgewise and mortised into or passing through each other so as to form cells. It is brittle, of a foliated texture and heavy. Under the blow-pipe it decrepitates if suddenly heated, but when reduced to powder it fuses, and is afterwards dissipated in the form of a white smoke. By fusion with borax it effervesces strongly and yields small reguline grains. It is totally soluble in Aqua Regia, and by the analysis of *Haquet* and *Klaproth* appears to consist of Oxyde of Antimony in union with Muriatic Acid. At *Cbalances* in *Dauphiné* it is sometimes intermixed with laminæ of grey antimonial ore, and at *Przibram* in *Bohemia*, from whence the finest specimens have been procured, it is found on galena accompanied with red blende.

## VARIETY I. CRYSTALLISED.

IV. a 1. In rectangular tetrahedral laminæ, of a mother of pearl colour and semitransparent, on crystallised galena. *Malazka, Hungary.*

V. a 2. The same, with red blende, on galena. *Przibram.*  
*Catal. de Raab*. III. D. a 1.

b. In stellated needle-like crystals.

## SPECIES V. RED ANTIMONIAL ORE.

*Oxide d'Antimoine combiné avec l'Acid arsenique et le Soufre*, *Kermes mineral natif*, Fr.  
*Rotb-Spießglaserz*, Germ.

This also rare ore of antimony, though said to occur sometimes in earthy lumps or interspersed, is most generally met with in delicate prismatic friable crystals, or flexible silk-like filaments, of a brownish purple colour, sometimes inclining to blue or steel grey. Its crystals or filaments are for the most part diverging or stellated, sometimes fasciculated. They are opaque; specific gravity said to be 4.7. Before the blow-pipe they melt very easily and emit a weak sulphureous smell, and by degrees are entirely dissipated. The composition of this ore has not as yet been accurately investigated, but by *Born* it

is stated to consist of Antimony, Acid of Arsenic and Sulphur; *Mr. Sage* considers it as a *Native Kermes Mineral*. It is found generally accompanied with grey antimonial ore in white quartz at *Malazka* and *Cremnitz* in *Hungary*; with muriate of antimony at *Braunsdorf* in *Saxony*, and also with native antimony at *Allemont* in *Dauphiné*.

#### VARIETY I. CRYSTALLISED.

VI. *a 1.* In delicate silky filaments, of a dark brownish red colour, concentrated into stars, with white opaque quartz, indurated clay and yellow pyrites. *Braunsdorf*.

VII. *a 2.* In numerous diverging fasciculi, inclining more to the purple, on white spongy quartz with stellated sulphuret of antimony and yellow pyrites. *Same place..*

#### VARIETY II. AMORPHOUS.

*a.* Intersperfed.

*b.* Earthy.

#### SPECIES VI. SULPHURET OF ANTIMONY.

*Grey antimonial ore. Antimoine sulfuré, Fr. Grau-Spießglaserz, Germ.*

There are few ores more remarkable than this for splendour and variety of form, and of the ores of antimony it is by much the most general. Its colour is bluish or steel grey, corresponding to that of the common antimony of the shops, which is indeed nothing else than this ore separated from its impurities by means of fusion. It is of metallic lustre, and often beautifully variegated on the surface. It occurs in lumps, intersperfed, or more or less delicately crystallised. In the mass its texture is either compact, granular or foliated, more commonly however divergingly striated or fibrous; when crystallised, its form, if determinate, is that of compressed hexahedral prisms with obtuse tetrahedral pyramids, which are either comparatively large, massy and longitudinally grooved, or more frequently in lengthened needle-like or capillary prisms diverging from different centres and variously decussating each other. It is opaque; brittle; very easily scratched by the knife, sometimes even so soft as to soil the fingers; gives a blackish powder; specific gravity from 4.194 to 4.516. Its metallic part is most easily soluble in aqua regia, from which it may be precipitated in the form of an oxyde by the effusion of water. Under the blow-pipe it is very easily fusible, giving out a white sulphureous smoke; on the dissipation of its sulphur by a more gentle heat it leaves a  
grey



grey vitrifiable oxyde, equivalent, according to *Bergman*, to about 74 per cent. of regulus.

Though most commonly associated with different forms of quartz, it is also not unfrequently found with limestone, fluor, indurated clay, iron pyrites, and ponderous spar, through the solid crystals of which last those of this ore pass frequently in various directions. It is met with very abundantly in the mines of *Bareuth*, the *Bannat*, *Saxony*, *Transylvania*, *Tuscany*, *Corfica*, and of many other parts; but more especially rich and beautiful from *Cornwall*, *Lubillac* in *Auvergne*, and *Felsobanya* in *Upper Hungary*.

#### VARIETY I. CRYSTALLISED.

VIII. *a* 1. In long hexhedral prisms somewhat compressed, terminated some by tetrahedral, others by dihedral pyramids, the crystals very numerous and crossing each other in various directions, an opaque grey quartz.

*Cremnitz, Hungary.*

*R. de L. Pl. 7, Fig. 13.*

IX. *a* 2. In flatted hexhedral prisms, very large, aggregated and diverging, of a splendid fracture, and laminated texture, deeply grooved on the surface and terminated by tetrahedral pyramids; from the sides of the larger crystals project at acute angles numerous smaller ones, accompanied in many parts by an incrustation of minutely crystallised quartz.

*Lubillac, Auvergne.*

X. *a* 3. In short hexhedral prisms terminated at both extremities by tetrahedral pyramids, on the surface of granular grey antimonial ore, with grey capillary antimonial ore and brown blende.

*Cornwall.*

XI. *b* 1. In long prisms compressed and diverging, of a laminated texture and covered by a yellow antimonial oxyde, with brownish ponderous spar.

*Felsobanya.*

XII. *b* 2. The same, diverging from a common centre, and penetrating the substance of transparent rhomboidal ponderous spar.

*Same place.*

XIII. *b* 3. In long slender needle-like crystals, diverging from different centres and entangling numerous minute crystals of white lenticular ponderous spar, on spongy white quartz.

*Same place.*

XIV. *b* 4. In shorter and more aggregated needles, variously decussating each other, in cellular white quartz.

*Cremnitz.*

XV. *b* 5. The same, in more delicate crystals, iridescent on the surface.

*Felsobanya.*

K k 2

XVI. *b* 6.

XVI. *b* 6. The same, the colour still more lively. *Felsőbánya.*

XVII. *b* 7. In iridescent capillary filaments, delicate, flexible, and diverging from different centres, on spongy ferruginous quartz. *Same place.*

XVIII. *b* 8. In long compressed needle-like crystals, diverging also from different centres and closely interwoven at their extremities. *Cremnitz.*

XIX. *b* 9. The same, incrusted on the surface by a brownish ochry oxyde. *Same place.*

XX. *b* 10. In prismatic diverging crystals, with semitransparent realgar, on compact striated sulphuret of antimony and opaque white quartz. *Schemnitz.*

XXI. *b* 11. In splendid bar-like crystals, of a laminated texture, confusedly aggregated and covered partly by a brownish red, and partly by a yellowish incrustation. *Pereta near Sienna, Tuscany.*

## VARIETY II. AMORPHOUS.

XXII. *a* 1. Of a compact fibrous texture, somewhat incurvated and of a dull leaden grey colour, incrusted with yellow oxyde of antimony. *Cornwall.*

XXIII. *b* 1. Of a striated texture, forming stellæ in a mixture of calcareous spar and clay with yellow pyrites, having transparent lenticular calcareous spar on the surface. *Schemnitz.*

XXIV. *b* 2. Of a converging striated texture, brilliant in its fracture. *Hungary.*

XXV. *b* 3. The same, in narrower striæ. *Transylvania.*

XXVI. *b* 4. Composed of striated laminæ, intermixed with yellow oxyde of antimony. *Savoy.*

XXVII. *b* 5. The same, intermixed with white quartz. *Ilefeld.*

XXVIII. *b* 6. The same, intermixed with pale red quartz, and covered on the surface by reddish yellow oxyde. *Corfica.*

XXIX. *b* 7. Of a striated texture, intermixed with and incrusted by yellow oxyde. *Auvergne.*

*c.* Foliated. *Vide No. 26, 27, 28.*

XXX. *d.* 1.

XXX. *d* 1. Of a granular texture, intermixed with white quartz. *Hungary.*

XXXI. *e* 1. Of a compact texture, light grey colour, and angular fracture.  
*Same place.*

## SPECIES VII. PLUMOSE ANTIMONIAL ORE.

*Federerz, Germ.*

This takes its name from being generally found covering the surface of other mineral substances in delicate capillary crystals, which are confusedly interwoven, and have a flocculent or lanuginous appearance. Its colour is intermediate between steel and bluish grey, sometimes greyish black, often tarnished or variegated. Its fibres are brittle and of but little splendour; when compacted it is internally of a fibrous texture and for the most part of a metallic lustre. Before the blow-pipe it gives out a thick white smoke and melts into a black slag, which is sometimes found to contain a small proportion of silver; it is therefore by *Baron Born*, and many others, ranked with the silver ores (*Argent antimonial, Argent en Plumes*). According to *Bergman* it consists of Antimony, Sulphur, Iron, Arsenic, and Silver. Its most common associates are quartz, calcareous, pearl, and ponderous spars, galena, iron pyrites, and blende. It is found at *Freyberg* and *Braunsdorf* in *Saxony*, at *Stollberg* in the *Hartz*, *Schemnitz* in *Hungary*, &c.

### VARIETY I. CRYSTALLISED.

*a.* In slender prismatic needles.

*b* 1. In delicate filaments lying in flocculi, on the surface of dodecahedral quartz.  
*Felsobanya.*

## GENUS VII. MANGANESE.

*Magnesium. Manganese, Fr. Braunsstein, Germ.*

This regulus, after perfect fusion, is of a whitish steel grey colour, uneven fracture and granular texture, hard, brittle, and of perfect metallic splendour. Its specific gravity from 6.85 *Berg.* to 7. *Hielm.* It is not attracted by the magnet except when reduced to powder, and then probably from the presence of a small proportion of iron. In general it is found to pass readily on exposure to moist air into a state of oxyde, at first of a whitish and afterwards of a blackish brown colour; similar changes are produced on it by torrefaction, but next to platina, it is of all the metallic bodies the most difficult

difficult of fusion. It is soluble in all the mineral acids, but most readily in the nitric, in which, when free from iron, it affords a colourless solution. It may be united by fusion with all the other metals, except quicksilver, rendering gold and iron more fusible, and copper less so. It cannot be combined with sulphur. In its metallic state no useful application has as yet been made of it. Its ores are,

#### SPECIES I. NATIVE MANGANESE.

*Manganese natif*, Fr. *Gediegen-Braunstein*, Germ.

It is found in small somewhat flattened or reniform globules of a greyish white colour and metallic lustre, having a divergently foliated texture, and being in some degree malleable. It soils the fingers. In the mass it is not obedient to the magnet. It was first discovered by *Mr. La Peyrouse* in the valley of *Vicdessos* near *Sem* in the neighbourhood of *Foix, Pyrenees*, imbedded in native oxyde of manganese of a silver grey colour. *Journ. de Phys.* 1786, *Janvier*.

#### VARIETY I. OF PARTICULAR SHAPES.

a. Globular.

#### SPECIES II. NATIVE OXYDE OF MANGANESE.

*Oxide de Manganese*, Fr. *Grau-und Schwarz-Braunsteinerz*, Germ.

The degree of oxydation occasions a remarkable difference, as in the case of iron, in the colour, lustre, texture, and other properties of this ore; hence the divisions of it by authors into grey, black, &c. striated, foliated, &c. It occurs either amorphous, superficial or interspersed; or of particular shapes, as stalactitical, mammillated, &c. in aggregated diverging fasciculi; or more or less distinctly crystallised, and then in truncated tetrahedral rhomboidal prisms, these also frequently diverging, and often entangled in each other. When crystallised, or of a striated or fibrous texture, or foliated and of metallic splendour, its colour is generally steel grey, inclining sometimes to greyish, brownish, or bluish black. It is opaque; brittle; so soft as to soil the fingers; specific gravity, according to *Briffon*, from 4.18 to 4.81. When without splendour, it is generally greyish, bluish, or brownish black, sometimes liver brown or brownish red; of different degrees of induration, and more or less of an earthy texture; forming sometimes superficially a kind of spumescence (*Braunstein-schaum*) on other ores, particularly on hematite. The dull and splendid varieties of this ore are often intermixed. By calcination this oxyde acquires a darker colour, but does not become magnetic. To glass of borax it imparts a reddish brown colour inclining to violet. In pure nitric acid it is only soluble after long digestion, or on the acid being partially decomposed by the addition of sugar, gum arabic or other

other analogous substances. In the muriatic, on the contrary, it dissolves with effervescence, converting a certain portion of it into oxymuriatic acid gas. The earthy variety of this ore, known by the name of *Black Wad*, possesses the remarkable property of taking fire spontaneously, when mixed with a fourth part of its weight of linseed oil and exposed to a gentle heat. According to *Bindheim*, the crystallised native oxyde of *Ilefeld* contains a small proportion of Lime and Ponderous Spar, a smaller still of Copper, but no Iron. *Wedgwood* found the black wad to contain Oxyde of Manganese 43, Oxyde of Iron 43, Lead 4.5, Mica 5. The varieties of this ore are commonly found with iron ochre, hematite, and spathose iron ore, in baryte or quartz, sometimes also in hornstone, jasper, indurated clay, calcareous spar, &c. Its more ponderous and brilliant varieties are met with in *Bareuth*; at *Annaberg*, *Jobngeorgenstadt*, and *Eibenstock*, *Saxony*; at *Sem* in the county of *Foix*, in *France*; at *Piedmont*, in *Italy*; at *Ilefeld* in the *Hartz*; at *Ilmenau* in *Thuringia*, and many other parts; and the earthy varieties in still greater abundance in all the foregoing places and many others. It is found in large quantities in *Devonshire*, *Cornwall*, *Derbyshire*, *Somersetshire*, *Yorkshire*, &c. and besides its use as a pigment, it is extensively employed in glass-making and in bleaching.

#### VARIETY I. CRYSTALLISED.

I. *a* 1. In fasciculi, composed of tetrahedral rhomboidal prisms truncated at their extremities, confusedly aggregated and projecting in various directions from the surface of an aggregated mass of the same. *Ilefeld?*

II. *a* 2. The same, of a brighter colour, and in somewhat larger crystals on the surface and in the cavities of compact ore of the same, intermixed with transparent quartz. *Ilefeld.*

III. *a* 3. The same, in diverging fasciculi, closely aggregated and crossing each other in various directions. *Ilmenau.*

IV. *b* 1. In long needle-like crystals converging to different centres and forming fasciculi, in plated white opaque baroselenite. *Ilefeld.*

V. *b* 2. In very minute and numerous crystals, of a dark steel grey colour, lying on the surface of brown indurated ochre. *Germany.*

#### VARIETY II. OF PARTICULAR SHAPES.

VI. *a* 1. In cylindrical stalactites of a brown colour, indurated and botryoidal on the surface. *Nassau Siegen.*

VII. *b* 1.

VII. *b* 1. In small tuberculi of minute aggregated crystals, on the surface of tuberous and cavernous quartz. *Ilefeld.*

VIII. *b* 2. The same, on the surface of coarse brown hematite. *North America.*

IX. *b* 3. In a compact irregular mass of a greyish black colour, botroidal on the surface. *Mendip Hills, Somersetshire.*

X. *b* 4. The same, of a more compact texture and shining fracture, mammillated on the surface. *Ilefeld.*

### VARIETY III. AMORPHOUS.

XI. *a* 1. In an irregular mass, composed of diverging striae of a dark brown colour, with a mixture of steel grey. *Mont Sivelina, Venice.*

XII. *a* 2. In radiating fibres, compact, and intermixed with compact radiating greenish white silicious manganese. *Piedmont?*

*b.* Granular.

XIII. *c* 1. In an irregular angular mass, compact, ponderous, and of a dark brown colour, with an ochry incrustation on the surface, (*Pierre de Perigord*). *Perigueux, France.*

XIV. *d* 1. In a flatted indurated earthy piece, of a dark brown colour, with numerous small crystals of rhomboidal tabular baroselenite on the surface. *Switzerland.*

XV. *d* 2. In an irregular piece, indurated, earthy and ponderous, of a yellowish brown colour. *Hungary.*

XVI. *d* 3. In a light compact irregular mass, of a liver brown colour and indurated earthy texture. *Devonshire.*

XVII. *d* 4. The same, of a lighter colour and more ponderous. *Somersetshire.*  
This is the sort made use of at glass-houses.

XVIII. *d* 5. In small loose indurated earthy fragments, of a dark brown colour inclining to black, more ponderous than the last. *Same place.*

XIX. *d* 6.

XIX. *d* 6. In a slightly cohering mass, very light, of an earthy texture and blackish brown colour. (*Black Wad.*) *Derbyshire.*

XX. *d* 7. The same, of a dun colour, and so light as to swim on water. *Hartz.*

### SPECIES III. SILICEOUS ORE OF MANGANESE.

*Manganese blanc, Oxide de Manganese d'un blanc rougeâtre, Fr. Roth-Braunsteinerz, Germ.*

This occurs either of a white, or more frequently of a paler or deeper rose red colour, sometimes tarnished externally brownish or yellowish. It is found either amorphous, interspersed, or of particular shapes, as stalactitic, mammillated, botryoidal, &c. or crystallised in rhomboidal parallelepipeds. It has little or no splendour or transparency; its fracture generally fine grained or uneven, inclining somewhat to the foliated; its fragments indeterminately angular and sharp edged; nearly of sufficient hardness to give fire with steel; specific gravity according to *Kirwan* 3.233. In the nitric acid it is soluble with effervescence and yields a colourless solution. Under the blow-pipe it resists fusion, but becomes black; to glass of borax it imparts a violet colour. According to the analysis of *Ruprecht* it contains Oxyde of Manganese 35, Silica 55, Iron 5, and Alumina 5. It has been met with at *Offenbanya, Kapnic* and *Nagyag* in *Transylvania*, where it forms the matrix of the grey gold ore, accompanied by quartz, blende, galena, fahlerz, copper pyrites, &c. &c.

By many it is justly considered as bearing a close analogy to pearl spar.

#### VARIETY I. CRYSTALLISED.

*a.* In rhomboidal parallelepipeds.

*b.* Indeterminate.

#### VARIETY II. OF PARTICULAR SHAPES.

*a.* Stalactitic.

XXI. *b* 1. In an irregular mass, intermixed with grey gold ore, mammillated and ochry on the surface. *Nagyag.*

XXII. *b* 2. In an irregular plate, of a reddish white colour, tuberculated and minutely crystallised on the surface. *Same place.*

*c.* Botryoidal, &c.

## VARIETY III. AMORPHOUS.

a. Striated.

XXIII. b 1. In an irregular shattery mass, of a reddish white colour, intermixed with auriferous pyrites. *Nagyag.*

c. Earthy.

## GENUS VIII. SCHEELÉ.

*Sebelium. Tungstenite, Kirw. Scheel, Germ.*

A new semimetal, which has hitherto been procured only in small globules, externally of a brown colour, internally steel grey with metallic lustre. In this state it is brittle and of great weight, being according to *Messrs. Elbnyart*, 17.600. It is more difficultly fusible than the regulus either of manganese or of uranite, but on being exposed to the combined action of heat and air is converted into a yellow oxyde, which exceeds the original weight of the regulus in the proportion of 124 to 100. A similar oxyde (*Acid of Tungsten*) may be obtained from it by treatment with the nitric or with the oxy-muriatic acid, in both which however as well as in the other mineral acids it is insoluble. It produces no diminution in the ductility either of silver or of copper, but increases the hardness of iron, tin, antimony, bismuth and manganese. The ores of this semimetal are,

## SPECIES I. TUNGSTATE OF LIME.

*Tungsten. Lapis ponderosus. Tungstene, Fr. Schwerstein, Weisser Zinnstein, Germ.*

Is for the most part of a yellowish or greyish white colour, changing not unfrequently into yellowish grey, and sometimes superficially into pearl grey or yellowish brown. It is generally found in lumps or interspersed, also occasionally crystallised and then always in octohedrons and their modifications. It is semitransparent; its fracture foliated inclining to the conchoidal, and having an unctuous or diamond splendour; seldom of sufficient hardness to give fire with steel; brittle; specific gravity according to *Briffon* 6.66. It is not soluble in water, and but partially so in acids even by the assistance of heat; with the nitric or muriatic it assumes a yellow colour. Under the blow-pipe it decrepitates and is infusible *per se*, but with microcosmic salt it effervesces and melts into a bluish globule. According to the analysis of *Scheele* it consists of Tungstenic Acid 44, Lime 56. It has been chiefly met with at *Schlackenwald, Schönsfeld* and *Platten* in *Bohemia, Ebnensriedersdorf*



*Ehrenfriedersdorf* in *Saxony*, and *Bitberg* in *Sweden*, associated with spathose tin ore (with which it was long confounded), quartz, mica, steatite, talc, iron ochre, &c.

#### VARIETY I. CRYSTALLISED.

I. *a* 1. In semitransparent white aluminiform octohedrons, on a mixture of mispickel and wolfram. *Schönfeld, Bobemia.*

*Catal. de Raab IX. C. b. 1.*

II. *a* 2. In dull white opaque aggregated octohedrons having the apices of both pyramids deeply truncated, on brown spathose tin ore in large irregular compounded crystals with white quartz. *Bobemia.*

*R. de L. Pl. III. Fig. 3.*

*b.* Indeterminate.

#### VARIETY II. AMORPHOUS.

III. *a* 1. In a small semitransparent mass, irregularly rounded. *Bobemia.*

IV. *a* 2. The same, in an irregular piece, with brownish indurated clay on the surface. *Same place.*

#### SPECIES II. WOLFRAM.

*Wolfram, Ecume de Loup, Fr. Wolfram, Germ.*

Is of a dark brownish black colour, sometimes superficially variegated or tarnished of a bluish grey. It is found in lumps, interspersed, in plates, or crystallised in compressed hexedral prisms with tetrahedral pyramids. It is always opaque. Externally it has little splendour, internally its lustre approaches to the metallic. Its fracture is longitudinally foliated, transversely uneven; fragments indeterminately angular; when scratched with the knife, to which it yields pretty readily, it gives a reddish brown streak. Specific gravity, according to *Briffon*, 7.119. By the mineral acids it is affected nearly in the same manner as tungsten. Under the blow-pipe it decrepitates without fusion; with borax it effervesces and communicates to it a greenish yellow colour by the application of the interior and a reddish by that of the exterior flame: it effervesces also with nitric cosmic salt and tinges it by the exterior of a pale and by the interior of a darker reddish colour. By the analysis of *Messrs. d'Elbucart* it is stated to consist of Tungstic Acid 50, Oxyde of Manganese 22, Oxyde of Iron 13, Silica and Tin 2. The wolfram of *Al-*

*dice* in *Cornwall* yielded *Mr. Klaproth* Tungstenic Acid 46.9, Oxyde of Iron 31.2, and some Arsenic.

Wolfram, like Tungsten, is found only in primitive mountains. It is principally met with in the mines of *Bobemia*, *Saxony*, and *Cornwall*. It was formerly considered by some as an ore of iron, by others as a particular species of manganese, and by many as a variety of the common tin ore, by which it is almost always accompanied together with quartz and mica.

#### VARIETY I. CRYSTALLISED.

- a.* In compressed hexedral prisms with tetrahedral pyramids.
- b.* Indeterminate.

#### VARIETY II. AMORPHOUS.

V. *a* 1. In long and narrow converging striæ, shining in their fracture, in coarse brown indurated steatite. *Bobemia.*

VI. *b* 1. In broad laminæ, of a scaly texture and dark brownish black colour, with green carbonate of copper and white quartz. *Cornwall.*

VII. *b* 2. In masses of a laminated texture composed of confused crystals, with brown spathose tin ore and white quartz, on gneiss. *Bobemia.*

VIII. *b* 3. Of a laminated texture and somewhat specular on the surface, with transparent greyish quartz. *Altenberg.*

IX. *b* 4. The same. *Bobemia.*

X. *b* 5. The same, in narrow striated laminæ, imbedded in whitish quartz. *Jobngeorgenstadt.*

XI. *b* 6. The same, of a dark brown colour, with blue indurated clay on white quartz. *Same place.*

XII. *b* 7. Of a dark brown colour in closely compacted laminæ, having a divergingly striated appearance, with quartz and grey indurated micaceous clay. *Same place.*

XIII. *c* 1. Of a close granular texture and brown colour, with yellowish mica in large plates. *Altenberg.*

#### GENUS

## GENUS IX. URANITE.

*Uranium. Uranit, Fr. Uran, Germ.*

The properties given to this semimetal by *Mr. Klaproth*, by whom it was discovered in 1789, are the following. Its colour, dark steel or iron grey inclining internally to brown; lustre weakly metallic; hardness nearly the same with that of tin; brittle; specific gravity 6.440.

As yet it has been obtained only in small imperfectly cohering globules, being extremely difficult of fusion. It is soluble both in the nitric and oxy-muriatic acids. Its oxyde, which is of a yellow colour and is also soluble in these and in most other acids, communicates to microcosmic salt and to the concrete phosphoric acid a grass green colour, but with soda or borax it melts into a greyish or brownish opaque porous or scoriaceous bead. Its effects upon the other metallic bodies are not yet known. The ores of this new semimetal are,

## SPECIES I. NATIVE OXYDE OF URANITE.

Which occurs either in small quadrangular tables or cubes, generally of a deep or yellowish green colour (*Calcolite. Gruner-Glimmer, Grun Uranerz, Germ.*) or in lumps, disseminated or incrusting other substances, and of a lemon yellow colour inclining sometimes to red or green, (*Uranokker, Germ.*) When crystallised it is transparent and of considerable lustre, its fracture foliated, streak greenish white, not brittle nor particularly heavy. The amorphous, on the other hand, is without either lustre or transparency, of an earthy fracture, and, in general, easily friable. In either form it is soluble in the nitric acid and precipitable by the Prussian alkali. By a strong heat the yellow changes its colour to a brownish grey, but is infusible; the green is infusible by alkalies. According to the experiments of *Klaproth*, the green colour of the crystallised and the reddish colour of some varieties of the semi-indurated, depends on the accidental presence, in the former of a small proportion of Oxyde of Copper, and in the latter of Oxyde of Iron. The rest he considers as Uranite in union with Carbonic Acid, or more probably in a state of Oxyde, as seems now to be the general opinion.

The general associates of this rare ore are, compact brown and red iron stone, iron ochre, quartz, hornstone, and indurated clay; it is also very frequently accompanied by pech-blende and sometimes, the semi-indurated more especially, by a bluish mineral substance, which, according to *Mr. Karsten's* description, resembles the variegated ore of copper. The mines, from whence the native oxyde of uranite has been almost exclusively obtained,

obtained, are those of *Saska* in the *Bannat*, *Jobngeorgenstadt* and *Eibenstein* in *Saxony*, and *Joachimsthal* in *Bohemia*.

#### VARIETY I. CRYSTALLISED.

I. *a 1.* In thin rectangular plates, of a straw yellow colour, on an ochry micaceous indurated schistus. *Jobngeorgenstadt.*

II. *a 2.* The same, in more minute plates of a grass green colour changing to a greenish yellow, on coarse ferruginous quartz. *Same place.*

III. *a 3.* The same, of a perfect grass green colour, some of the crystals of sufficient thickness to become cubic, on an ochry indurated clay intermixed with quartz and mica. *Same place.*

IV. *b 1.* In indeterminate crystals of the same colour, on black compact scaly pechblende somewhat shining in its fracture. *Same place.*

#### VARIETY II. AMORPHOUS.

V. *a 1.* Of an earthy texture and yellowish white colour, on the surface of pechblende. *Georgewagsford, Saxony.*

#### SPECIES II. SULPHURET OF URANITE.

*Pechblende, Fr. Schwarz-Uranerz, Emmerling.*

There is but little variety in the colours and forms of this ore, being generally of different shades of greyish black, and found for the most part in lumps, or interspersed, sometimes cellular, very rarely reniform, and never crystallised. It is sometimes iridescently tarnished on the surface; always opaque. Its lustre internally semi-metallic inclining to the unctuous and sometimes to that of the diamond. Its fracture conchoidal approaching to the uneven; brittle; not of sufficient hardness to give fire with steel; streak darker coloured; specific gravity 7.500. Its metallic part dissolves most readily in the nitric acid or in aqua regia, yielding solutions of a pale yellow colour. Under the blow-pipe it is infusible *per se*; with soda or borax it gives a grey opaque slag, and with microcosmic salt a clear glass of a grass green colour. According to *Klaproth* when separated from its ferruginous and other heterogeneous matter it consists of Oxyde of Uranite in union with a small portion of Sulphur, which, in the solutions above mentioned, remains undissolved.

undissolved. It has hitherto been found only at *Joachimsthal* in *Bohemia*, and at *Jobngeorgenstadt* and *Schneeberg* in *Saxony*.

#### VARIETY I. OF PARTICULAR SHAPES.

a. Reniform.

b. Cellular.

#### VARIETY II. AMORPHOUS.

VI. a 1. In a compact irregular mass of a dark brown colour and angular fracture.  
*Jobngeorgenstadt.*

VII. a 2. The same, of a pitch colour and solid texture, covered by dark grey indurated clay intermixed with decomposing yellow pyrites.  
*Same place.*

VIII. a 3. The same, in opaque grey quartz, with yellow pyrites and red arseniate of cobalt.  
*Same place.*

IX. a 4. The same, composed of thick layers intermixed with galena. *Saxony.*

#### GENUS X. MOLYBDENA.

*Molybdenum.* *Molybdene*, Fr. *Molybdän*, Germ.

Takes its name from the common molybdena, from which it was first obtained by *Mr. Hielm* in small agglutinated masses. It is externally of a whitish yellow colour, internally whitish grey, with a weak metallic lustre. It is brittle and not obedient to the magnet. Its specific gravity, according to *Heidinger*, 6.963, after some days immersion in water 7.500, *Kirwan*. Of the mineral acids it is most readily acted on by the nitric, by which it is converted into a white saline mass possessing properties similar to those of the acid of molybdena. Under exposure in the open fire to a red heat it is converted into a white flocculent oxyde, which is also acid to the taste and soluble in water; in close vessels it is nearly infusible. *Mr. Hielm* has succeeded in combining it with all the other metals, in each of which it produces an alteration of properties. The only ore of this new semi-metal is,

#### SPECIES

## SPECIES I. MOLYBDENA.

*Molybdene*, Fr. *Wasserblei*, Germ.

Which occurs in lumps, or interspersed, or, though less frequently, crystallised in hexhedral laminæ, sometimes accumulated on each other so as to form short hexhedral columns. Its colour leaden grey, inclining to red; its surface splendid, smooth and unctuous; its fracture curved-foliated; its laminæ flexible and opaque; so soft as to soil the fingers; specific gravity from 4.569 to 4.848. It is insoluble both in the sulphuric and marine acids; in the warm nitric acid it effervesces, leaving a greyish oxyde (*Acid of Molybdena*) which is soluble in about 570 times its weight of common water. In close vessels it is not affected by heat; in a strong open fire it emits a sulphureous smell and yields a greyish white flocculent oxyde and a yellowish semivitrified residuum. It is but little altered under the blow-pipe either by borax or microcosmic salt, but it effervesces with the fixed alkalis and communicates to them a reddish pearl colour. According to the analysis of *Klaproth* it consists of Molybdic Acid : c, Sulphur 40. It is found solely in primitive mountains at *Schlackenwalde* and *Zinnwald* in *Bohemia*, at *Altenberg*, *Geir*, *Ehrenfriedersdorf* and other parts of *Saxony*, and at *Norberg* and *Gerdfrum* in *Sweden*, frequently associated with or in the neighbourhood of spathose tin ore, and generally accompanied by wolfram, quartz and mica, more rarely by native arsenic, ponderous spar, fluor, topaz, &c.

## VARIETY I. CRYSTALLISED.

a. In hexhedral laminæ.

## VARIETY II. AMORPHOUS.

I. a. 1. In broad thin and shining laminæ, of a leaden grey colour, lying on each other in a parallel direction and intermixed with a small proportion of ferruginous quartz.

*Scotland.*

II. a. 2. In thinner and more compacted laminæ, on impure indurated clay with white quartz.

*Altenberg.*

III. a. 3. The same, disseminated through a coarse mixture of mispickel, white quartz, crystallised mica and wolfram.

*Same place.*

IV. a. 4.

IV. a 4. The same, also disseminated in red copper ore, on white quartz and incrustated with green malachite.  
*Levant Island, Spanish Town, America.*

## GENUS XI. TITANIUM.

This denomination is given by *Mr. Klaproth* to another new semimetal, the oxyde of which, according to his late experiments, is said to be contained in the red schorl of *Boinik* in *Hungary*, and of several other analogous substances. This supposed oxyde, when pure, is of a white colour, and by calcination changes to a yellow and afterwards to a red, and in contact with charcoal, to a blue. It affords a yellow enamel. From the mineral acids, in all of which it is soluble, it may be precipitated by the prussian alkali, the acid of galls and sulphuret of ammoniac; it is also thrown down by zinc of an indigo blue, and by tin of a pale red colour changing to that of the ruby: no means however, hitherto devised, have succeeded in reducing it to a perfect regulus.

The red schorl of *Boinik* above mentioned, which occurs in striated prismatic crystals of a light brownish red colour, imbedded in quartz intermixed with veins of micaceous schistus, by the analysis of *Klaproth* consists of Oxyde of Titanium with a small portion of Silex and Alumine; and by the analysis of *M. Vanquelin* and *Hecht*, the red schorl of *St. Yrieux* in *France*, found also of a reddish brown colour, in hexhedral prisms or rounded masses, appears to be of a similar nature. Oxyde of Titanium has likewise been discovered, by the foregoing chemists, in a blackish brown mineral met with at *Passau* in *Germany*, in tetrahedral prisms with smooth and shining surfaces, and more or less transparent; in reddish brown hexhedral prisms with hexhedral pyramids, from *Cajuelo* near *Vuitrage* in the province of *Burgos*; in another of the same kind found in the year 1787 by *Prince Dimitri von Gallitzin* in the granite of *Speessart* near *Aschaffenburg*; in rounded laminated grains of a greyish black colour, inclining to brownish red, mixed with the auriferous sand of *Oblapian* in *Transylvania*, and in the *Menachanite* discovered some years since by *Mr. Gregor* in a valley of the parish of *Menachan* in *Cornwall*.

## GENUS XII. SILVANITE.

By *Mr. Kirwan* this name has been given to the new semi-metal discovered in the *White Gold ore* of *Facebay* by *Mr. Muller*, and possessed of the following properties.

Its colour greyish white, lustre metallic, fracture granularly foliated, very brittle, specific gravity after fusion 6.343. It melts easily, and in the open fire is converted into a volatile white oxyde, approaching to the nature of an acid. It is most readily soluble in aqua regia, in which it yields a yellowish solution. By fusion it combines with

M m

fulphur

fulphur and forms with it a striated mass. With mercury it may be amalgamated by simple trituration. In the ore above mentioned, according to *Mr. Muller's* analysis, it is united in its Reguline state with Native Gold, together with a small proportion of Arsenic and Nickel. *Vide GOLD, SPECIES III.*

The existence of this as a new semi-metal has been farther confirmed by the late experiments of *Mr. Klaproth*, who has ascertained its properties more accurately, and given to it the name TELLURIUM. According to his analysis the *White Gold ore* of *Facebay* contains Tellurium 92.55, Iron 7.20, Gold 2.5; the *Graphic Gold ore* of *Offenbanya*, Tellurium 60, Gold 30, Silver 10; the *Yellow Gold ore* of *Nagyag*, Tellurium 45, Gold 27, Lead 19.5, Silver 8.5, and a minute quantity of sulphur; and the *Foliated Grey Gold ore* of *Nagyag*, Tellurium 33, Gold 8.5, Lead 50, Sulphur 7.5, Silver and Copper 1. *Vide Annales de Chimie, Tom. XXV. P. 273.*

### GENUS XIII. C R O M E.

Lately discovered by *M. Vauquelin* in the red lead ore of *Siberia*, which he considers as composed of the Acid of this metal in combination with Oxyde of Lead. The metal itself he states to be of a greyish white colour, and in the form of needles entangled in each other, very brittle and very difficult of fusion. Under the blow-pipe it acquires a lilac crust, which in cooling becomes green, and communicates this colour to glass of borax. The nitric acid is the only one which has any remarkable action on it. By repeated distillation with this it is converted into a greenish and at length into an orange yellow powder, soluble in water and having an acid taste, combinable also with the alkalis, and having farther the remarkable property of precipitating the nitrate of silver of a cinnabar red, nitrate of lead of an orange yellow, and nitrate of copper of a chestnut red colour.

From these and other circumstances *M. Vauquelin* thinks himself authorised to consider this substance as a new semi-metal. *Vide Annales de Chimie, Tom. XXV. Pag. 21 and 194.*

CLASS



CLASS IV. *INFLAMMABLES.*

These are such mineral substances as are more especially remarkable for exhibiting the phenomena of combustion, by which, like other inflammable bodies, they undergo an entire change in their properties, and with a few exceptions furnish, in the opinion of the modern chemist, the basis of particular acids. They are comparatively of less specific gravity and hardness than most of the other bodies of the mineral kingdom. They are insoluble in water, and almost as generally so in spirits of wine. Many however are soluble in oils, more especially in the essential oils. Such as contain charcoal are capable of decomposing, by the assistance of heat, both the sulphuric and nitric acids and their saline compounds, and of effecting the reduction of the metallic oxides.

In medicine and in the arts, and as articles of fuel, they are substances of general utility.

ORDER I. *AERIFORM.*GENUS I. *HYDROGEN GAS.*

*Inflammable Air. Gaz hydrogene, Fr.*

Takes the name of hydrogen from the remarkable property of producing water under combustion with oxygen gas. It is the lightest of all the permanently elastic fluids, being when pure, according to *Lavoisier*, to atmospheric air in the proportion of 0.094 to 1.000.

SPECIES I. *COMMON HYDROGEN GAS.*

This is generally found in coal mines, and for the most part in mixture with bituminous or coaly matter, and also with carbonic acid gas, by which last its specific gravity is considerably increased. It burns with a blue flame, and is often productive of dangerous explosions.

SPECIES II. *SULPHURATED HYDROGEN GAS.**Hepatic Gas. Gaz hepaticque, Fr.*

Common Hydrogen Gas holding Sulphur in solution. This burns with a light blue flame, has an offensive smell, and is somewhat heavier than common air; it is also sometimes found in coal mines, but most frequently in mineral waters or in caverns adjacent to volcanos, and is often the result of the decomposition of certain kinds of pyrites.

ORDER II. *LIQUID.*GENUS I. *LIQUID BITUMEN.**Erdoel, Germ.*

The species of this genus are generally believed to be of an animal or vegetable origin, and to differ from each other principally in their colour and degrees of consistence.

SPECIES I. *NAPHTHA.**Naphte native, Fr. Naphta, Germ.*

Found on the surface of certain springs, or issuing from certain strata, in the form of a light thin yellowish, often colourless oil, highly odoriferous and inflammable. Its specific gravity from 0.708 to 0.847. It is insoluble in spirits of wine, and by the nitric acid is thickened, but not inflamed. In distillation it rises without being decomposed. When exposed to the air it becomes at first of a darker yellow colour, and afterwards brown and of a greater degree of consistence. It is found in *Persia*, on the borders of the *Caspian sea*; in *Calabria*, *Sicily*, *Modena*, and *America*.

I. a 1. Transparent and of a yellowish colour.

*Persia.*

II. a 2. The same, of a deeper colour.

*Same place.*

III. a 3. The same, of a still deeper colour.

*Italy.*

## SPECIES

## SPECIES II. PETROLEUM.

*Petrol*, Fr. *Gemeines Erdoel*, Germ.

Is generally of a dark blackish brown colour, of less tenuity and transparency than naphtha, not so inflammable, and of a less agreeable odour; specific gravity from 0.847 to 0.878. It is in a slight degree soluble in spirits of wine, and in burning affords a sooty flame, leaving a small quantity of coaly residuum. In distillation it yields a thin colourless oil similar to naphtha, an empyreumatic acid, a brown empyreumatic oil and a certain quantity of carbonic acid gas. It is generally the produce of strata of secondary formation, more particularly such as abound in coal, from which it frequently exudes. It is met with sometimes in considerable quantity in the coal mines of *Sbropsbire*, in *Lancashire*, in the neighbourhood of *Edinburgh*, and other parts of *Great Britain*; in *Persia* and the *East Indies*; in different parts of *Italy*, *France*, *Switzerland*, and *Germany*; in *Sweden* and *Siberia*, and also in *North America*.

IV. a 1. In a fluid state, opaque and of a reddish black colour. *Gabion.*

V. a 2. The same, of a darker colour and thicker consistence. *Sumatra.*

VI. a 3. The same, of the consistence of treacle. *India.*

## SPECIES III. BARBADOES TAR.

*Petrol tenace*, Fr. *Bergtheer*, *Zäbes Erdpech*, Germ.

This is of a dark reddish or brownish black colour, nearly of the consistence and tenacity of common tar and having a bituminous smell; specific gravity 1.1. It burns with a thick smoke, and is partially soluble in spirits of wine. The most common kind with us is that from the *Island of Barbadoes*. It is found also in different parts of *Persia*, *France*, *Norway*, *Sweden*, *Siberia*, &c.

VII. a 1. Of a deep reddish black colour, of the consistence of tar. *Barbadoes.*

VIII. a 2. The same, of the consistence of honey. *Auvergne.*

## ORDER III. SOLID.

## GENUS

## GENUS I. SOLID BITUMEN.

*Erdpech*, Germ.

This genus is in reality little more than a continuation of the former, the characteristic properties of which pass insensibly into those of solid or concrete bitumen, in which the nature and proportion of extraneous admixture constitutes the chief distinctions.

## SPECIES I. ASPHALTUM.

*Malta. Asphalté*, Fr.

Is either of the colour and consistence of common pitch (*Mineral Pitch*) or completely indurated, of a conchoidal fracture and glassy lustre (*Indurated Petroleum*). When heated it has a bituminous odour, it melts easily, is very inflammable, and when pure burns without leaving any ashes; specific gravity from 1.4 to 2. It is said to be found floating on the lake *Asphaltés*, whence its name; specimens are also brought from *Auvergne* in *France*, the *Island of Trinidad*, and various other parts.

*Mr. Hatchet* is justly of opinion, that the progressive changes of naphtha into petroleum, mineral tar, mineral pitch, and asphaltum, are caused by the gradual dissipation of part of the hydrogen of the bitumen and the consequent disengagement of carbon. Vide *Trans. of the Linn. Soc. Vol. IV. P. 132.*

I. In an irregular piece of a black colour, brilliant lustre, and conchoidal fracture.

*Auvergne.*

II. The same.

*Derbyshire.*

III. In detached fragments of a greyish colour, found in the cinnabar mines of

*The Duchy of Deux Ponts.*

IV. In an irregular portion, with crystallised calcareous spar.

*Auvergne.*

## SPECIES II. JET.

*Bitume de Judée*, Fr. *Schlackiges Erdpech*, Germ.

Is of a deep black colour, sometimes inclining to brown, but considerably harder and less brittle than asphaltum. It breaks with a conchoidal fracture and is internally of  
a glassy

a glassy lustre. It has no odour except when heated; specific gravity 1.104. It melts in a strong heat, and when burned leaves an earthy ferruginous residuum. It is partially soluble in spirits of wine; with unctuous oils it melts into a black varnish. It occurs in most of the places already mentioned as productive of the other forms of bitumen.

V. Compact, of a shining vitreous fracture and susceptible of a fine polish.

*County of Foix in France.*

VI. In irregular shattery layers interposed between plates of white calcareous spar.

*Saxony.*

### SPECIES III. COAL.

*Cbarbon de Terre, Fr. Steinkoble, Germ.*

Coal, in the opinion both of *Mr. Kirwan* and *Mr. Hatchet*, is to be considered as composed of Bitumen intimately mixed or rather combined with various proportions of earthy or stony matter; it is in most instances also impregnated with pyrites. The common properties of this substance are universally known. It always occurs in beds more or less horizontal, of different degrees of thickness and at different depths; most commonly in strata of grit, or of argillaceous schistus. It is found in considerable abundance in the northern, western, and southern parts of *France*, in the *Netherlands*, *Westphalia*, *Duchy of Deux Ponts*, and many other parts of the continent; in *China*, the northern parts of *America*, and in inexhaustible quantities in most of the counties of *Great Britain* and *Ireland*.

### VARIETY I. COMPACT.

VII. Of a shattery fracture and very iridescent.

*Bannat.*

VIII. In a flatted portion striated on the surface.

*Maastricht.*

IX. Of a black colour, foliated fracture, and very splendid.

*Kilkenny.*

Vide *Kirwan Elem. of Mineral*. Vol. II. P. 50 and 520

X. Of a black colour, rather less splendid, but more brittle (*Culm*). *South Wales*.

*Kirwan*, Vol. II. P. 51.

XI. Of a black colour and common lustre, in its cross fracture conchoidal (*Cannel Coal*).

*Lancashire.*

*Kirwan*, Vol. II. P. 52 & 523.

XII. Of

XII. Of a black colour, greasy lustre and foliated fracture. *Whitehaven.*  
*Kirwan, Vol. II. P. 54, & 525.*

XIII. Of a black colour, foliated fracture, and but little lustre. *Swansea.*  
*Kirwan, Vol. II. P. 55 & 526.*

XIV. Of a black colour, composed of layers varying alternately in their lustre (*Riband Coal*). *Irwine, Scotland.*  
*Kirwan, Vol. II. P. 56.*

#### VARIETY II. SLATY.

XV. Of a greyish black colour, little lustre, fracture partly slaty, partly imperfectly conchoidal (*Splent Coal*). *Argyleshire, Scotland.*  
*Kirwan, Vol. II. P. 524.*

#### VARIETY III. BITUMINOUS WOOD.

XVI. *a 1.* In a flatted piece of a brown colour and without lustre. (*Surtur-brand, Bituminöses Holz.*) *Iceland.*

XVII. *b 1.* Of a brownish black colour and lamellated texture.  
*Obf. et Mem. sur la Physiq. Tom. XXXVII, Pag. 275. Utznack, Swisserland.*

XVIII. *c 1.* Of a brownish black colour and close slaty texture.  
*Phil. Trans. Vol. LI. & XLIX. Bovey Heath, Devonshire.*

#### VARIETY IV. PEAT.

#### SPECIES IV. MINERAL ELASTIC GUM.

*Elastic Bitumen. Caboutchou fossile, Fr.*

Is generally of a yellowish, reddish, or blackish brown colour, inclining sometimes to green, and of an elasticity and consistence intermediate between those of softened cahoutchou and the finer kinds of cork-wood. In some instances it is nearly liquid and adheres readily to the fingers, in others indurated and friable. The specific gravity of the more elastic is, according to *Mr. Hatchet*, 0.9053. When heated it inflames and emits an unpleasant odour. It dissolves in unctuous oil, but is insoluble in spirit of wine, æther and oil of turpentine, and is not affected by the nitric acid. Under distillation it yields an  
7  
empyreumatic

empyreumatic oil and a carbonaceous residuum. By *Mr. Hatchett* the elastic bitumen is considered as a modification of naphtha or petroleum, susceptible of a further alteration of property, by maceration in water and long exposure to air. It was first discovered in the year 1789, in a vein of the *Odin Lead Mine* near *Castleton, Derbyshire*, associated with galena, fluor, calcareous and ponderous spar, quartz, blende, calamine, selenite, and asphaltum.

XVII. Of a shining black colour and compact, with cubic fluor and calcareous spar on grey limestone. *Odin Mine.*

XVIII. Of a greyish black colour, soft and elastic to the touch and of a conchoidal fracture, without matrix. *Same place.*

## GENUS II. AMBER.

*Electrum, Succinum. Succin, Fr. Bernstein, Germ.*

The usual appearances of this substance authorize the appropriation of its title to two species, viz.

### SPECIES I. HONEY-STONE.

*Pierre de Miel, Fr. Honigstein, Germ.*

Found near *Artern in Thuringia* in the fissures of bituminous wood, in insular or aggregated octohedral crystals, of a honey yellow colour inclining to hyacinth red; semi-transparent; brittle; of a conchoidal fracture and vitreous splendour; easily scratched by the knife; specific gravity 1.666. It is not electric upon friction. When heated it becomes partly black and partly of a white colour, fumes and falls into powder, but does not inflame, nor is it soluble either in spirit of wine or unctuous oils. According to the late analysis of *M. Abich* it consists of Carbonate of Alumine 16, Carbon 4, Oxyde of Iron 3, Carbonic Acid 40, Water of crystallisation 28, Naphtha 5.5. Vide *Annal. de Chim. Tom. XXVIII. Pag. 76.*

### VARIETY I. CRYSTALLISED.

*a.* In octohedrons, or double tetrahedral pyramids joined base to base. *Catal. de Raab. T. II. P. 90. III. A. 4.*

*b.* Indeterminate.

N n

SPECIES

## SPECIES II. COMMON AMBER.

*Succin*, Fr. *Bernstein*, Germ.

Found in irregular lumps generally of a yellow colour, sometimes inclining to red, brown or black, more rarely to green or white, and with more or less transparency. Its fracture conchoidal; lustre unctuous; easily scratched by the knife. Specific gravity from 1.078 to 1.085. By friction it becomes electric and emits an agreeable odour, more especially if heated. In spirits of wine, æther, essential oils, alkaline solutions and in all the acids, except the sulphuric, it is nearly or altogether insoluble, but in the native balsams and unctuous oils it completely dissolves and forms different kinds of varnish. Heated in contact with air it inflames, and gives out a thick white highly odorous smoke leaving a black brilliant spongy coal. In distillation it yields a reddish acid phlegm, a light whitish or yellowish oil, a volatile concrete acid salt (*Acid of Amber*), and a compact coaly residuum amounting to about  $\frac{1}{4}$  of the whole. According to the analysis of *Baumer* it consists of Petroleum 72, Acid of Amber 4.5, and Water. Amber is universally supposed to be of vegetable origin. That it must once have been fluid is shewn by the insects and other foreign bodies, which it so frequently contains. It is found in different countries, more particularly in *Prussia*, at considerable depths in the neighbourhood of or resting on bituminous wood, often also at the bottom of the *Baltic* sea intermixed with sand or gravel, or cast on shore, particularly after storms.

## VARIETY I. AMORPHOUS.

I. *a* 1. In rounded transparent portions of different colours, inclosing insects and other heterogeneous bodies. *Coast of Prussia.*

II. *a* 2. Larger portions of the same. *Same place.*

III. *a* 3. In a transparent nodule of a pale yellow colour. *Coast of Suffolk.*

IV. *a* 4. In a round piece, rough on the surface.

V. *a* 5. In loose irregular pieces.

VI. *a* 6. Semitransparent, of a yellowish colour with opaque white veins.

VII. *b* 1. Of a yellowish white colour and opaque with reddish veins.

VIII. *b* 2. Of a brownish black colour.

*Sicily.*



## GENUS III. MINERAL TALLOW.

*Bergfet*, Germ.

According to the description of *Mr. Kirwan*, is of a white colour, of the feel and consistence of tallow, stains paper and melts on the application of heat, and burns with a blue flame accompanied with much smoke. Specific gravity 0.770. It is imperfectly soluble in alcohol, but is said to dissolve in oil of almonds. It was first discovered in *Finland* in 1736, afterwards in a lake in *Sweden*, and since by *Dr. Herman* in a fountain near *Straßburg*. Specimens of this substance of a dull or brownish white colour with a shade of green, and of greater specific gravity than the above, viz. 1.014, have been lately brought from *New Holland*, where it is said to occur in large quantities.

I. In a rounded portion of a white colour, soft texture, and soapy feel?

*West Florida.*

## GENUS IV. SULPHUR.

*Sulphur. Soufre*, Fr. *Schwefel*, Germ.

When free from earthy and other impurities, is of a pale greenish yellow colour, insipid, insoluble, burns with a blue flame and suffocating odour, in close vessels sublimes unchanged, is converted under combustion into sulphuric acid by the absorption of oxygen, and has many other properties too generally known to require enumeration. Its combinations with the metallic and other bodies have been already mentioned. In a separate state it is met with either in the neighbourhood of volcanos or mineral hepatic springs, or in veins or beds most frequently of gypseous or argillaceous strata. Hence the following distinction.

## SPECIES I. COMMON SULPHUR.

*Gemeiner natürlicher Schwefel*, Germ.

It occurs either in lumps, interspersed, superficial, or crystallised, in semitransparent rhomboidal octohedrons and their varieties, and generally associated with calcareous spar or gypsum. It is found in different parts of the world, as at *Guadeloupe*, *Wiliczb* in *Poland*, *Launstein* in *Hanover*, *Italy*, *Bevieux* in the *Canton of Berne*, *Orenberg*, *Catbarinenberg* and other parts of *Siberia*, and in specimens more particularly rich and beautiful from *Conilla* near *Cadiz* in *Spain*.

## VARIETY I. CRYSTALLISED.

I. Pure sulphur artificially crystallised.

II. *a* 1. In rhomboidal octohedrons, transparent and of a citron colour with minutely crystallised calcareous spar, on bluish indurated clay. *Conilla.*

*R. de L. Pl. V. Fig. 1 & 4.*

III. *a* 2. The same, with confusedly aggregated crystals of different figures, on the surface of pyramidal calcareous spar, on bluish indurated clay. *Same place.*

*R. de L. Pl. V. Fig. 8 & 9.*

IV. *b* 1. In small brilliant polyhedral crystals, perfectly transparent, with very minute crystallised calcareous spar, on bluish indurated clay intermixed with sulphur.

*Same place.*

## VARIETY II. AMORPHOUS.

V. *a* 1. In irregular pieces, of a foliated texture and bright citron colour, intermixed with calcareous spar, on bluish indurated clay. *Conilla.*

VI. *a* 2. Semitransparent, of a foliated texture, and brownish yellow colour.

*Cape de Verd Isle.*

Of a bright citron colour and transparent, with white calcareous spar, on grey limestone. *Bevioux.*

VII. *a* 3. Of a light yellow colour, in laminated gypsum. *Hartz.*

VIII. *a* 4. In irregular fragments of a pale yellow colour and foliated texture.

*Bobemia.*

IX. *a* 5. The same, less transparent.

*Hungary.*

X. *b* 1. Of a light yellow colour and granular texture.

*Kamtschatka.*

XI. *c* 1. Of a mealy appearance, covering the internal surface of a portion of hollow flint. *Auvergne.*

XII. *c* 2. In a powdery form, of a yellowish white colour, separated from the waters of *Aix la Chapelle.*

## SPECIES

## SPECIES II. VOLCANIC SULPHUR.

*Vulkanischer natürlicher Schwefel, Germ.*

This also occurs in various forms as superficial, interspersed, stalactitic, cellular, &c. and sometimes, though less frequently, crystallised. It is found in large quantities in most volcanic countries, as at *Teneriffe*, Islands of *Java* and *Iceland*, *Italy*, *Sicily*, &c.

## VARIETY I. CRYSTALLISED.

XIII. *a* 1. In delicate plumose crystals, of a light yellow colour, lining cavities, in an irregular cellular mass of dark shining native sulphur. *Italy.*

## VARIETY II. OF PARTICULAR SHAPES.

*a.* Stalactitic.

*b.* Cellular, &c.

## VARIETY III. AMORPHOUS.

XIV. *a* 1. In small semitransparent yellow grains. *Teneriffe.*

*b.* Compact.

XV. *c* 1. Of a spongy texture and yellowish white colour.

XVI. *c* 2. The same, of a pale yellow colour, but more compact.

## GENUS V. PLUMBAGO.

## SPECIES I. COMMON PLUMBAGO.

*Black Lead. Plombagine, Fr. Graphit, Germ.*

Is found either in lumps or interspersed, of a colour intermediate between bluish and light iron black, inclining sometimes to steel grey, and sometimes to brownish black, of a weak metallic splendour, opaque, fracture somewhat flaty or indistinctly foliated, of a  
fine

fine or coarse grain; yields easily to the nail; has an unctuous feel; soils the fingers, and gives a splendid streak; specific gravity according to *Kirwan*, from 1.987 to 2.089. It is insoluble in water and unalterable on exposure to air. When ignited in the open fire it undergoes slow combustion, leaving behind only a small portion of oxyde of iron. In close vessels it suffers no change, nor is it altered under the blow-pipe by borax or microcosmic salt, neither does it effervesce or unite with fixed alkalis. By deflagration with nitre it produces carbonate of potash. In the mineral acids it is insoluble. By the experiments of *Mr. Scheele* it has been proved to be a mineral charcoal combined with a small portion of Iron. It is found in different parts of *France, Germany, Spain*, and many other countries, but of the greatest purity at *Borrowdale* near *Keswick* in *Cumberland*, where it is found in siliceous limestone.

#### VARIETY I. AMORPHOUS.

- |            |   |                           |
|------------|---|---------------------------|
| I. a 1.    | In a flatted piece of a dark leaden grey colour.                        | <i>Borrowdale.</i>        |
| II. a 2.   | In an irregular piece of the same colour, with iron ochre.              | <i>North America.</i>     |
| III. a 3.  | The same, also with iron ochre.   | <i>Cape of Good Hope.</i> |
| IV. a 4.   | In a larger and more irregular piece.                                   | <i>Bohemia.</i>           |
| V. a 5.    | In an irregular piece intermixed with quartz.                           | <i>Same place.</i>        |
| VI. a 6.   | The same, of a bluish colour on the surface.                            | <i>Scotland.</i>          |
| VII. a 7.  | Another specimen of the same.   | <i>Stiria.</i>            |
| VIII. a 8. | In rounded portions imbedded in brown siliceous limestone.              | <i>Borrowdale.</i>        |
| IX. b 1.   | Of a plated texture intermixed with quartz.                             | <i>Stiria.</i>            |
| X. c 1.    | Of a fine granular texture, intermixed with ochry white indurated clay. | <i>America.</i>           |

#### SPECIES

SPECIES II. *ANTHRACOLITH.*

*Plumbagine Charboneuse*, Born.

According to *Baron Born*, the anthracolith discovered lately at *Schemnitz* in *Hungary*, differs from common plumbago, in being very light and compact, of a shining conchoidal fracture, neither soiling the fingers nor staining paper, and in being easily broken, but without yielding to the knife. Under the muffle it gradually loses 90 per cent of its weight, and by analysis contains Carbon 90, Alumine 5, Iron 3, Silica 2. Vide *Catal. de Raab. Tom. II. P. 296.*

VOLCANIC PRODUCTIONS.

For the distribution of these, see the Appendix to the Systematic Arrangement, Page 26.

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